

Technology Transfer Is a Process of Quiet Matchmaking

When it comes to technology transfer, rolamite (see stories this issue) is something of an anomaly. It exited Sandia with saturation news coverage and expectations that it would be widely applied.

But that was an exception. Technology transfer at the Labs most often has been a matter of quiet matchmaking.

Day in and day out, members of Technology Transfer & Management Dept. 6010 — the Labs' primary matchmakers — find themselves spending much time on the phone introducing people from industry who need technical information to Sandians

"We have some 600 people from industry visiting technical organizations every month."

who have it. Colleagues in Patent & Licensing Dept. 4050 and in other organizations throughout the Labs also lend a hand.

"Only occasionally do these matches result in immediate product breakthroughs or formal technology exchange agreements," explains Bob Stromberg (6010), "but they surely help build a program that's contributing bit by bit to the well-being of US industry."

The De Vore Story

A sheaf of recent phone messages on Bob's desk illustrates his point.

"Here's one," Bob says, "from Arnold Robinson, vice-president of De Vore Aviation Corporation of Albuquerque. He wanted to know more about our gyro-stabilized platform developed for some Defense Nuclear Agency-supported work" (see box, "Transfer by Luck or Serendipity").

The platform uses a gyroscope to ensure that it remains horizontal regardless of any motion to which the support is subjected. The gyroscope senses forces that try to alter the orientation of the platform; it then sends an electronic message to motors that adjust the platform accordingly.

Coming Down to Earth

Satellite Battery Redesigned for Terrestrial Use

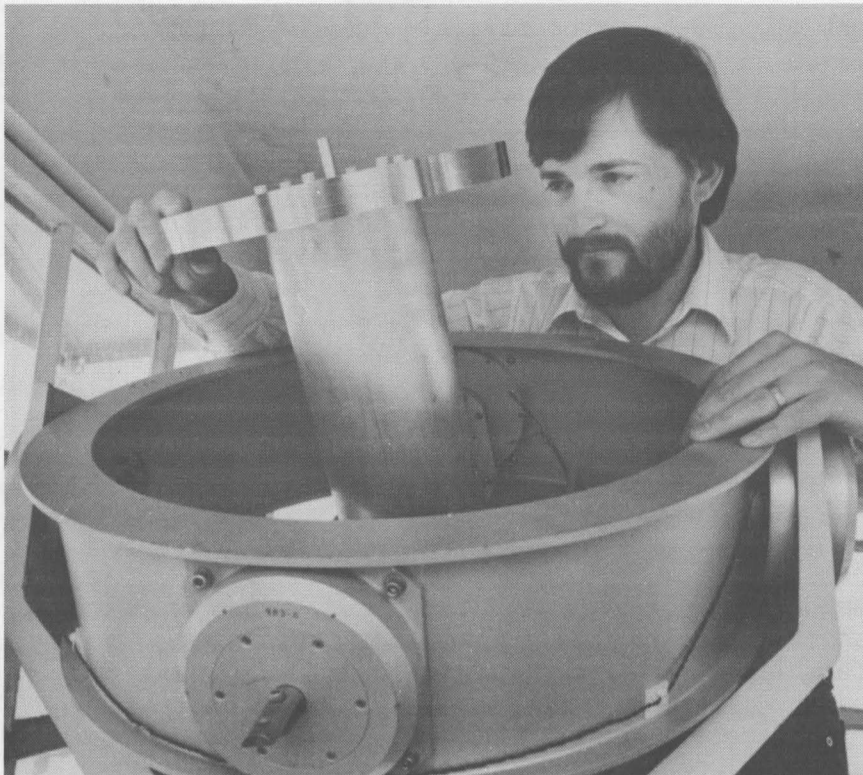
Since October 1957, when Sputnik I announced the dawn of the space age, more than 3500 payloads — most of them military, commercial, and scientific satellites — have been successfully rocketed beyond earth's atmosphere. Billions of dollars and years of research have gone into developing reliable space hardware.

Now, Sandia is working with industry to bring one of those proven space components — the nickel/hydrogen battery — back to earth. Already, costs have been reduced dramatically from the \$25,000-per-kilowatt-hour (kWh) space version, down to \$823 per kWh. The goal is to slash it even more, to \$375 per kWh.

Developed in the early '70s by Comsat Laboratories (Clarksburg, Md.) and used for more than a decade for energy storage in communications satellites, nickel/hydrogen batteries may find valuable uses on earth — storing electricity for solar-powered refrigerators that preserve vital medicines at health-care clinics in remote parts of the world, for example.

"The characteristics that make these batteries ideal for space vehicles — long life, high reliability, and low maintenance — make them particularly attractive for use at remote sites," says Ron Diegle, supervisor of Storage Batteries Div. 2525 and manager of the Exploratory Battery Technology Development

(Continued on Page Eleven)



TONY SMITH (9131) with a gyro-stabilized platform like the one that Albuquerque's De Vore Aviation wants to incorporate into its PLASI system for aiding pilots during aircraft landings. De Vore would replace the cylindrical test object (shown here) with its system.

How does this Sandia device fit into De Vore's line of aviation-related products?

"For several years," Arnold Robinson says in response to a LAB NEWS call, "we have been wanting to develop a stabilized platform that could be combined with one of our current products, the PLASI [Pulse Light Approach Slope Indicator] system."

A PLASI, which is mounted near the end of an airport runway, produces visual signals that tell a pilot whether his glide path is too high, too low, or right on target. If the pilot doesn't maintain a correct glide path, he sees lights that signal how he needs to alter

his approach to return to the correct path. All of this requires that the pilot and the PLASI maintain a constant horizontal attitude with respect to each other.

De Vore has sold some 250 PLASIs to airports and heliports worldwide; the US Air Force recently decided to install it in all of its air bases.

"What we have been after, however," Arnold continues, "is a way to adapt PLASI so that it can be used on military ships, oil exploration ships or tankers, commercial liners, large cargo vessels, even large tuna boats or large VIP yachts — essentially on

(Continued on Page Four)



LAB NEWS

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SANDIA NATIONAL LABORATORIES

JUNE 16, 1989



REAR ADMIRAL JON "MIKE" BARR, who becomes DOE Deputy Assistant Secretary for Military Application on July 1, visited Sandia for briefings and a tour on June 5. Here, Bob Peurifoy (VP 7000) points out major features in the technical areas that he and Admiral Barr then visited via helicopter. President Al Narath and other Sandians briefed the Admiral about Sandia's weapon and fusion programs. DOE's Office of Military Application is Sandia's primary customer, accounting for about 55 percent of the Labs' operating funds.

This & That

We Made It -- sort of. Most, maybe all, Albuquerque employees received the June 2 issue on time, but Livermore folks didn't get theirs until the next Monday. You may recall my column item in that issue about our switching to a new computerized typesetting and page makeup system. I was wondering whether we'd get the paper out on time.

Our local commercial printer had a passel of problems -- including equipment breakdowns in the middle of the night. Charles Shirley and I spent all night (Wed., May 31) there trying to help solve the problems, checking and rechecking proofs, and doing some serious hand-wringing.

I approved the final proof at 8:40 a.m. Thursday; the paper then had to be printed and delivered to our mail room by early that afternoon to make it to Livermore for Friday delivery. We'd have made it, but to top off the problems, the delivery man from the printer didn't have his required vehicle insurance card when he arrived at the KAFB gate. He had to return to the printing plant (about 10 miles) and get his card. That final foul-up caused late delivery to Livermore.

* * *

We Continue -- our series of technology transfer stories in this issue. I've long thought that the very term technology transfer sounds pretty dull. But, Sandia's tech transfer activities often have interesting, significant impacts on the business world. We hope our stories reflect that.

As our lead story indicates, Sandians do lots of tech transfer quietly, routinely passing along useful technical information and assistance to business and industry.

Other Sandia tech transfer is done with more fanfare -- such as the announcement 22 years ago of the rolamite -- the subject of several articles in this issue. Although it still sounds to me like a name for a pest-control company, rolamite is a clever friction-reducing device that can perform various mechanical and electromechanical functions. Invented for the weapon program by former Sandian Don Wilkes, rolamite has found one real niche in the commercial world. TRW Technar Inc. expects to sell about \$40 million worth of rolamite sensors this year, most for automobile air bags that protect passengers during crashes, and some for activating transponders for downed aircraft.

Thanks Rod Geer (3163) and Ace Etheridge (3161) for the stories.

* * *

What's the Word? -- As part of his research, Ace noticed that the dictionary definition for rolamite was preceded by the phrase "of unknown origin." Ace made a call to the G. & C. Merriam Company (Merriam-Webster publisher) to clear up the matter. Ace says the lady who answered his call was nearly ecstatic after he explained to her that the device was invented at Sandia and offered to send her documentation to that effect. Retiree Bob Fox coined the word, as detailed in one of Ace's sidebars. Now we'd like to know -- Have other Sandians coined new dictionary words? Let us know.

* * *

In-Depth Photography -- Our photographers, Randy Montoya and Gerse Martinez, often go to great lengths to get LAB NEWS photos. Now Randy has extended that to "great depths" also. Check out this issue's picture of Stan Ford, director of the Sandia Employees Recreation Program. You'll see what I mean.

oLP

feed back

Q. I get calls from various investment brokers at work. I do not want to be bothered by them here. I am not the only one receiving unsolicited calls. The last caller said our names are on an investor list being sold by Dunn and Bradstreet along with our work numbers. I have the names of two of these salesmen, but the fault lies with the list vendors. I do not like being interrupted by this sort of selling. How do we stop it?

A. Dun and Bradstreet, Paine-Webber, and Stewart-James were all contacted regarding the "investor lists" you refer to in your question. Many brokers do use lists obtained through groups such as Dun and Bradstreet. Brokers also obtain contacts through professional organizations such as IEEE, as well as personal referrals and numerous other sources. Sandia policy prohibits releasing personal information on its employees to outside organizations. Furthermore, the use or sale of our phone directory by Sandia employees for other than official business use is prohibited. Sandia discourages businesses from contacting Labs employees on the job, but cannot totally prohibit the practice. If a broker or any other business person calls you at work and you do not wish to be contacted, simply inform that person.

Ralph Bonner -- 3500

Q. Can something be done about abuse of carpool areas? I carpool every day and park in the lot east of the TTC. Recently, at about 7:30 a.m., I watched three "lone rangers" pull into the carpool section. They left when I told them it was reserved for carpools. Perhaps marking the area more clearly would help. Why not paint the curbs white and stencil "CAR POOL" on each curb?

A. We have requested painting of curbs/blocks as suggested. The Traffic Enforcement Section will continue to respond to complaints as appropriate and violators should be reported to the Traffic Enforcement Section (ext. 4-6410).

Jim Martin -- 3400

Q. There are existing cement bike stands/lockups at both the far east and west ends of the "water-tower lot." Would it be possible to add a few more on the first and second rows (south side) at some intermediate points? Open space is already marked off and available at the end of each sub-row from east to west. This would be a big help as more of us lock up bikes in the lot.

A. We took a survey of the existing concrete bike stands in the water-tower parking lot. Currently, 11 units are located in various areas of the parking lot; four are at the far east end, four at the far west end, and three by the DOE site. A Maintenance Service Request has been issued to have additional units installed at strategic locations in the central part of the lot.

Ward Hunnicutt -- 7800

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VP DAN HARTLEY (6000, second from right) wields the scissors at a brief ribbon-cutting ceremony earlier this month to dedicate Sandia's new Photovoltaic Device Fabrication Laboratory (PDFL), which is now in full operation. Lending enthusiastic support are (from left) Dan Arvizu (6010), Virgil Dugan (6200), and Don Schueler (6220). Located in Bldg. 883, the PDFL features a class-100 clean room and extensive data collection equipment to provide a precisely controlled processing environment for silicon solar cells. The PDFL's mission is to gain a better understanding of the effects of processing on cell performance to help the US solar industry obtain the high efficiencies in its own commercially produced cells that, until now, have been obtained only in research labs. The PDFL will be the subject of a future LAB NEWS article.

Tockey Helping Develop Quality Initiatives

At the request of Allied Signal/Kansas City — a DOE production plant — Bob Tockey, supervisor of Telemetry Systems Div. I 8451, will be on special assignment at Allied-Signal for about a year.

Bob, who left earlier this month, says, "I was asked by Allied to serve as design-agency liaison and consultant, and will be helping the Kansas City Division develop its quality initiatives."

Jim Barham (8450) elaborates: "Bob will focus on quality-assurance and quality-control initiatives at Allied to determine what we here at Sandia — as designers — can do to further enhance and facilitate high-quality production. His work should result in a better awareness, by both Sandia and Allied, of important design and manufacturing considerations."

Streamlining Production Flow

Bob will work closely with Allied's Focused Electronic Factory on streamlining production flow on the factory floor and simplifying information systems.

"We'll be looking at ways to eliminate 'zero-value-added' operations and, at the same time, how to improve output quality and reduce the work-in-progress inventory," Bob says.

"Even after you draw material out of stores and begin the manufacturing process, the material remains in inventory until it is accepted by DOE and shipped; that can be a slow process involving a large amount of money."

Bob will also work with Allied's Electronic Continuous Improvement Business Unit Steering Committee — a group of management and staff people involved in the manufacture of electronic products. The Committee oversees and assists quality-improvement efforts in Allied's individual departments.

"Right now, Sandia and Allied have a number of product problems — some having to do with manufacturability," notes Bob. "I don't intend to get deeply involved with specific product problems, but will become very involved in why they become problems,

how they are solved, and how they can be avoided in the future."

Both Albuquerque and Livermore

With VP Glen Cheney's (2000) concurrence, Bob will work with both Albuquerque and Livermore groups involved in the design of electronic subsystems for weapons. "I hope that Sandians who think I can help them — or who think they can help me — will contact me," says Bob. His FTS phone number is 977-5954, and his mailing address is Mail Code MD40, Allied Signal/Kansas City Division, P.O. Box 419159, Kansas City, MO 64141-6159.

Jim Barham notes that the Kansas City special assignment is expected to continue after Bob has finished his tour of duty, and that the activity will alternate between Albuquerque and Livermore representatives. Also, sometime in the future, an Allied-Signal staffer may be assigned to Albuquerque and Livermore to further enhance the interface. ●

Take Note

Vera Chandler (8273) captured four awards in the 51st annual Pleasanton Rose Show held over Mother's Day weekend at the First National Bank of Pleasanton. She won first place for her red rose entry, two seconds for her pink and orange roses, and third place for another variety of pink roses. This is Vera's fourth year in the show, and her "winningest" year so far, she says.

Sandian Heads Supercomputer Working Group

Sandian Karen Sheaffer (8235) is chairing a new standards group that will investigate methods to exchange software between minicomputers and supercomputers.

The organization — composed of computer scientists from Sandia, other national labs, government contractors, and all US supercomputer manufacturers — is called the Portable Operating System for Computer Environments (POSIX) Supercomputing Working Group. It was established by the Institute of Electrical and Electronics Engineers' Technical Committee on Operating Systems.

"For the first time in computer-science history," Karen says, "a standard, portable operating system that lets computer users move application software freely between all types of computers — from a PC to a Cray, for example — is emerging. Our new committee wants to extend this standardization to the supercomputing market."

"And, because all of this country's supercomputer companies are represented on the committee, we'll be able to build on their combined expertise."

Committee goals include developing a standard profile for supercomputer environments, working with other groups on required supercomputing extensions, and providing eventual software compatibility throughout the entire computing community.

The standard on which the Committee has chosen to base its work is the UNIX operating system. A main advantage of UNIX is its widespread availability, which provides a common computing environment for varying hardware architectures.

In the past, the UNIX system has been limited to minicomputers. The new group hopes to extend its use to supercomputers through investigations of high-performance disk input/output, job recovery, distributed batch interface, a FORTRAN environment, multi-tasking, and resource accounting.

"The POSIX standard will provide a single, verifiable interface standard," Karen notes. "As a result, application package developers will have a worldwide uniform market in which to distribute products." ●



LAST YEAR'S WINNING DIRECTOR Ron Detry (8200) recently presented the traveling trophy for best Directorate Challenge race participation to this year's winner — himself. More than 150 people from 8200 turned out for the fun run, topping the other four Livermore directorates by a substantial margin. The historic photo involves two pictures of Ron and some technical magic.



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THEY'RE SMILING — with good reason. Carl Melius (DMTS, 8357, right) recently made an additional \$1000 contribution last month to the Livermore schools science award program. The program, started by Carl with a \$1500 gift in 1987 (using his DMTS award money), enables teachers to attend seminars and helps purchase science classroom equipment. Shown with Carl (from left) are Assistant Livermore School Superintendent Eva Long and science teachers Marie Timmer and Judy Hazen. Marie and Judy have received grants through the program.

(Continued from Page One)

Quiet Matchmaking

any sea vessel large enough for helicopter or even fixed-wing aircraft landings."

Starting the 'Real Work'

Clearly, for that to work, PLASI must be mounted on a platform that can keep the horizontal reference constant even when a ship is bobbing in the sea. Bob Stromberg put Arnold in touch with Tony Smith (9131), who, while in Division 5261, was responsible for development of the specific gyro-stabilized platform design that interests De Vore. Tony provided De Vore with mechanical drawings for the platform and will soon be providing electrical and electronic design details as well.

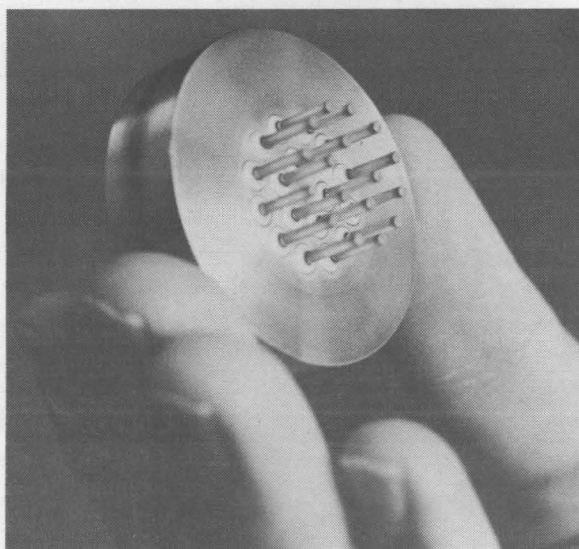
"When we have all of that information," Arnold says, "the real work will begin. We'll need to develop a complete understanding of the Sandia platform before we are able to start development of a prototype for our application."

"PLASI and the stabilized platform will essentially have to be married into one system. There'll have to be a new control system, a power system that can be operated from shipboard, and techniques to ensure that the enhanced PLASI will be seaworthy. To be successful, it'll have to survive the winter waters of the North Sea."

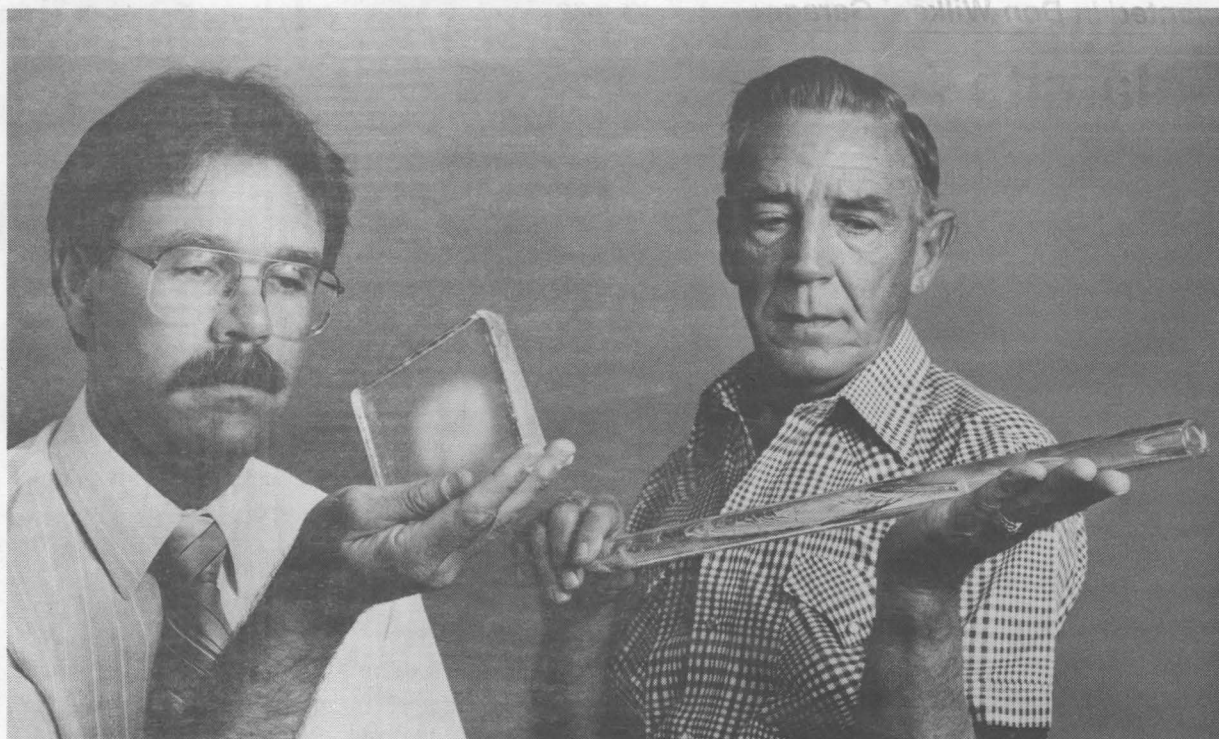
Arnold believes it will take more than a year and a minimum of \$250,000 in development costs — a considerable financial investment for a company of its size — before De Vore will have a marketable product.

"But having seen how well Sandia's stabilized platform works," he says, "and having been given the opportunity to learn something about the Labs' development work, I'm sure the transition from a Sandia-specific tool to a product that can be used on ships can and will be made."

So, if all goes well, just what does the crystal ball reveal for some four to five years in the future? "A platform-stabilized PLASI could well be a market-developing product," he says, "not just a product to fill an existing void. That's exciting."



MULTI-PIN electrical feed-through that uses Sandia S-Glass for high-strength glass-to-metal seals. This feed-through is part of a connector assembly, to be built by BIW's Connector Systems, for an electronic instrumentation package designed for use during tests at the Nevada Test Site.



TWO FACES of Sandia S-Glass — on its way up the Labs' tech transfer hit parade — are displayed by members of Division 7476. Scott Reed holds a bubble-free slab that was cast by Ted Montoya (7476-3). It will be cut into smaller cubes for use in weapon components. Ken Peters displays a solid rod that will be redrawn by Applied Glass Technology, Brunswick, Ga., into smaller-diameter pieces suitable for use in components.

"First of all, many ship owners may want to install a platform stabilized PLASI simply for safety reasons. That's essentially serving an existing need. However, availability of this new product also may influence other ship owners and operators to add he-

"Throughout my travels, I'm regularly receiving comments that Sandians are open and friendly to our visitors from industry and business."

liport capability to their vessels. It's these applications that will form a new market."

And all of that would likely mean more employment by De Vore, which today has a work force of about 50 and annual sales of approximately \$4 million.

Rest of the Iceberg

Despite all of the matchmaking activity that goes on (see "Phone Messages Reveal Other Tech Transfer Interests"), Bob believes it represents only the tip of the iceberg when it comes to technology-transfer-related interactions that go on every day at the Labs.

"We have some 600 people from industry visiting

technical organizations every month," he says. "Since many of those visits are arranged without our involvement, they don't have a technology transfer tag, but lots of transfer still goes on."

Responses to tech-transfer-activity questionnaires that Bob began sending out in 1981 confirm that, but there is a lot of anecdotal evidence as well.

"Recently," Bob says, "I was attending a Chicago meeting of the Federal Laboratories Consortium, and a very friendly gentleman approached me. He almost hugged me, and I'd never seen him before."

The man turned out to be Al Young, manager of special projects for Connector Systems, a division of BIW Cable Systems, Santa Rosa, Calif.

The day before the Chicago meeting, Al had visited Howard McCollister (DMTS, 7476) to learn more about S-Glass technology. Patented in 1983 in the names of Howard and Scott Reed (also 7476), the glass-ceramic compositions known as Sandia S-Glass have been widely applied by American manufacturers in such products as pyrotechnic devices, battery headers, connectors, metal-backed substrates for high-temperature electronic circuits, and well-logging devices. When there's a high-temperature application that will involve expansion of a glass-metal interface, S-Glass/Inconel 718 is a winning combination.

(Continued on Next Page)

Phone Messages Reveal Other Tech Transfer Interests

Other recent examples of technology transfer activities culled from the sheaf of some 50 recently answered telephone messages on Bob Stromberg's (6010) desk:

- A representative from a large aircraft company who wanted to learn more about Sandia's Synthetic Aperture Radar processor and its applicability for an unmanned air vehicle;
- An oil company employee who wanted more information about advanced techniques for mapping strata surrounding a borehole;
- An aerospace company engineer who inquired about Sandia's Airborne Remotely Operated Device (AROD), which is designed to enhance surveillance capabilities and reduce battlefield casualties;
- An electronic company representative who asked about portable intrusion sensors being studied by the 5200 Directorate;
- A person from a domestic steel company who wanted information about catalysis;

- A representative from a small advanced testing concern in Texas who inquired about proper techniques for administering low-velocity air flow tests; and

- A person from an Albuquerque firm that produces TV commercials who wanted to know about techniques for moving computer-generated text to video tape so that it isn't distorted when displayed on a TV screen.

"Also, these days," Bob says, "I spend a lot of time talking with representatives of companies who have learned about some of Cecil Land's [DMTS, 1163] most recent PLZT work that bears on new memory devices," Bob says. "Many are interested in obtaining licenses so they can engage in advanced development based on Cecil's work."

And, Bob reports, interest remains high in Bob Hughes' (1163) "artificial nose," a micro-electronic sensor that detects several kinds of hazardous gases even when they are mixed together.

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Rolamite Applications Are Few, But New Uses May Be Found

The subject of hundreds of articles and hailed as the first elementary mechanism invented in this century, rolamite was expected to have a big impact on dozens of technologies. Measure, lock, pump, turn on, turn off, amplify, entertain . . . you name it, this little gadget could do it.

So said its inventor, former Sandian Don Wilkes, and lots of others concurred. In 1967 he and his Sandia Labs colleagues prepared a lengthy report that outlined scores of tasks that could be performed by this simple roller-band device that he invented the year before.

Today no one is disputing that a rolamite could do all these tasks, but after two decades it has found only one niche in industry. It has proved to be an excellent acceleration sensor — otherwise known as a

As an impact sensor, the rolamite switch can activate a nuclear weapon or an automobile air bag.

G (for gravity) switch. As an impact sensor, the rolamite switch can arm a nuclear weapon or activate an automobile air bag. At a given acceleration level, the rollers simply snap to one end of the frame and close a switch. All the other uses for rolamite remain dormant, despite the evangelistic efforts of dozens of people both inside and outside of Sandia.

The trail of the rolamite can be traced to Don Wilkes' garage, where he invented the device on a fall evening in 1966. A Sandia mechanical engineer, Don had been working on a project to develop micro-miniature electromechanical devices. That evening he took his work home and made the first rolamite model in his garage workshop.

'Eureka, I Found It'

"I remember him coming back to work and shouting, 'Eureka, I found it,'" says Sam Martin, one of Don's co-workers back in 1966. Several years later, Don's discovery would prove to be important for Sam's career. Sam became a rolamite designer and recently was named supervisor of 2541 — which works with rolamites.

Don also invented the device that preceded the rolamite in its function as a weapon-safing switch. Called the 1107 switch, the device used a metered flow of nitrogen gas to move a small piston and close a switch when a certain velocity was reached.

When he invented the rolamite, Don explained that it was an important mechanism because — and this was hard for most to believe — it would move without sliding friction.

"This is particularly useful for very small things," he said, "because with excessive miniaturization you reach the place — a plateau — where the masses of

The Wall Street Journal, New York Times, Newsweek, Business Week, and Popular Science were just a few of the publications that carried articles on rolamite.

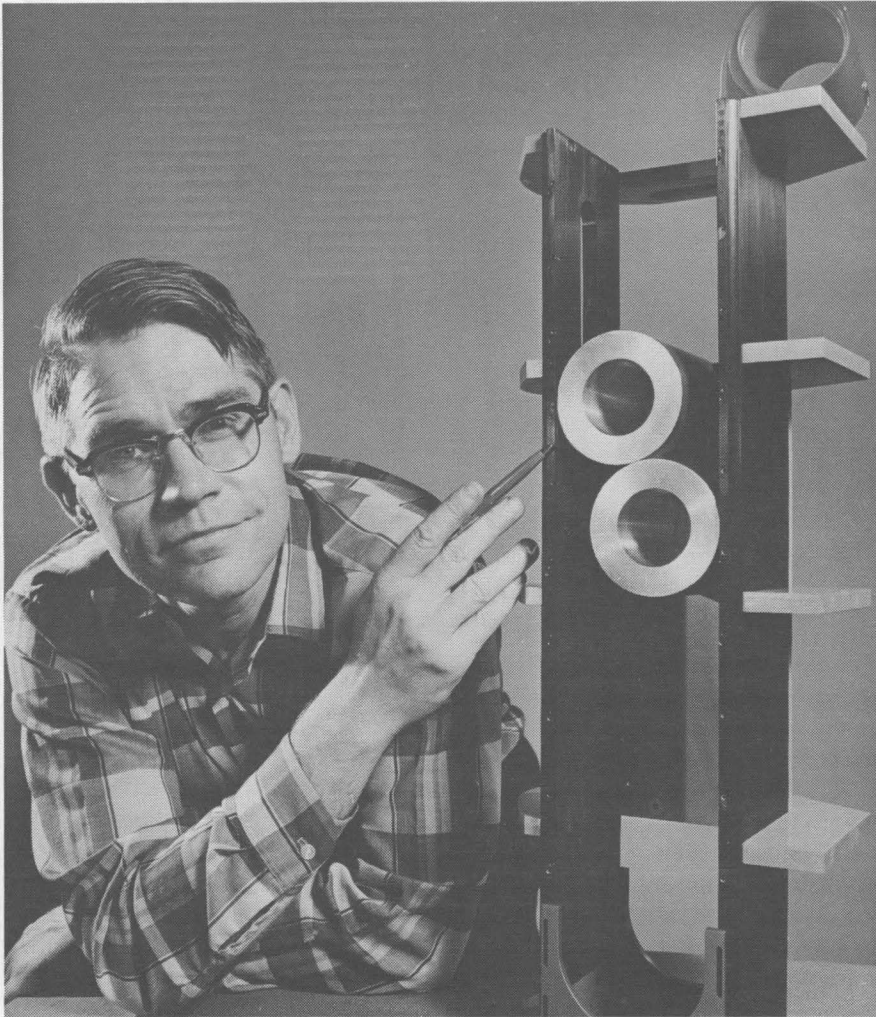
the individual components become small in comparison with the frictional forces present. Under these circumstances, you cannot use conventional devices such as bearings."

But Don envisioned dozens of other uses for his invention. With other members of Sandia's Electromechanical Department, he outlined those applications in a 215-page report replete with drawings.

Introducing Rolamite to the World

Corry McDonald (ret.) was head of Sandia's Office of Industrial Cooperation in the late '60s. He re-

(Continued on Page Six)



IN 1967 DON WILKES (former Sandian) explained his new invention with a large model of a rolamite.

(Continued from Preceding Page)

The patented process for producing S-Glass involves heating and cooling steps to melt the glass and convert it to a multiphase crystalline glass-ceramic. The coefficient of expansion of S-Glass closely matches that of hardened Inconel 718, a strong, corrosion-resistant, nickel-chromium-iron alloy used for high-temperature applications such as nuclear-reactor or turbine-engine parts.

Nineteen manufacturers, exclusive of integrated contractors, use the material, and 11 of the manufacturers have licensed the patent from DOE.

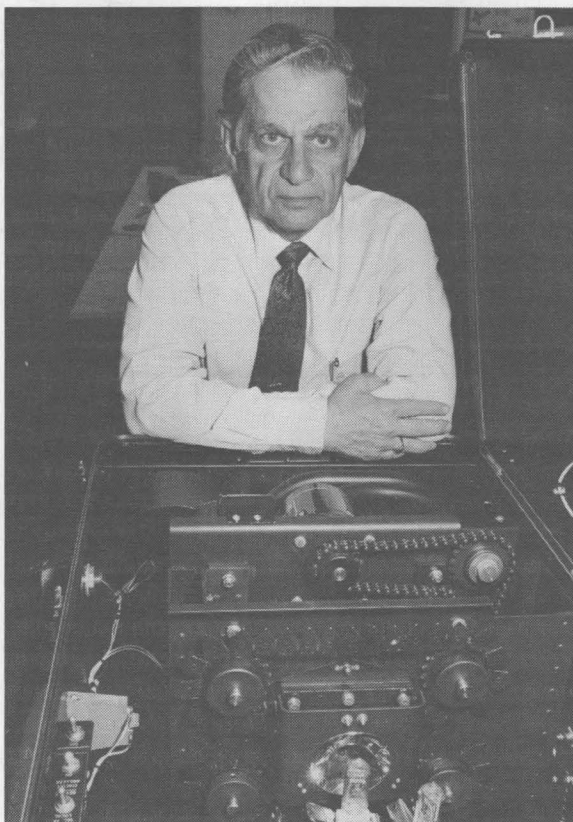
Bob says the reception he received from Al

Young isn't out of the ordinary. "Throughout my travels, I'm regularly receiving comments that Sandians are open and friendly to our visitors from industry and business. Unfortunately, that impression isn't easily conveyed in formal reports," Bob says.

"I wish it could be."

(Sandia glass and ceramics research and development have had an important impact on US industries during the past decade. Sol-gel glass thin coatings, the award-winning TA-23 glass, and the recently developed lithium-corrosion-resistant CABAL [calcium-modified boro-aluminate] glass family are developments that show up regularly on Labs' tech transfer activity lists. Future LAB NEWS technology transfer articles will cover these developments in more detail.)

●RGeer(3163)



DE VORE AVIATION's VP Arnold Robinson with a nearly complete PLASI that will be installed in a Norwegian airport. Tech transfer going on now between the Albuquerque company and Sandia could result in PLASI, a landing aid for pilots, being mounted on top of a Sandia-designed stabilized platform.

Transfer by Luck or Serendipity

While technology transfer can be the result of careful matching between donor and recipient, there's often a touch of luck or serendipity. Such was the case with De Vore Aviation Corporation's introduction to the gyro-stabilized platform, which may be the key to a new product that the Albuquerque company wants to develop.

"Several months ago," says De Vore Vice President Arnold Robinson, "we were interested in bidding on a Sandia job for the manufacture of a 30-in.-diameter spherical shell. We believed that our composite materials shop ought to be able to build the shell out of materials such as fiberglass, Kevlar, or graphite with an epoxy resin.

"I paid no attention to what would be inside the shell. But later, while I was looking at some of the Sandia design requirements for the shell," Arnold recalls, "the words 'stabilized platform' popped out at me.

"I knew immediately that we needed to know more about Sandia's stabilized platform. The phone call to Bob Stromberg opened the door to obtain that information and permitted us to proceed with our long-standing plans for the development of a stabilized PLASI system."

(Continued from Page Five)

Rolamite

members those days of the rolamite's infancy and its enthusiastic inventor. That enthusiasm, says Corry, was picked up by Sandia management, with the result that rolamite soon occupied many of Corry's hours.

"We were trying to spin it off," he recalls. "We developed it for accelerometers, but we tried to think of other applications."

One of Corry's first efforts was to research where the rolamite ranked in the mechanical engineers "hall of fame." "We couldn't find anything that essentially anticipated the rolamite, so we concluded it was one of the elementary mechanisms. Apparently, so did the patent office," he says.

"We couldn't find anything that essentially anticipated the rolamite, so we concluded it was one of the elementary mechanisms."

All new babies must have names, and to name Don Wilkes' mechanical child, his colleagues held a contest. The name "rolamite" — an acronym derived from roller, laminants, and mite — was submitted by Bob Fox (ret.), who was supervisor of one of the electromechanical divisions (see box, "Sandians Put Words in Dictionary").

A year after Don built his first rolamite, Sandia had his definitive research report, Corry's paper documenting the origin of 27 elemental mechanisms from the prehistoric wedge to the rolamite, a patent application, and a plan to publicly announce the invention. That plan was set into motion on Oct. 16, 1967, with a general press release.

Within a week, photographs of Don and his invention had appeared in newspapers across the country. *The Wall Street Journal*, *New York Times*, *Newsweek*, *Business Week*, and *Popular Science* were just a few of the publications that carried articles on rolamite. It was even the subject of a couple of syndicated cartoons.

Mixed Reaction From New York Press

Nigel Hey, now supervisor of Public Information Div. 3161, recalls the reaction of some New York

"It [rolamite] was one of those 'let's-run-it-up-the-flagpole' kind of things. It sounded too good to be true, but we didn't want to miss out on it."

journalists when he showed them a model of the new device.

"I took a handmade rolamite to New York and showed it around at the newspapers," Nigel says. One journalist was *The Wall Street Journal's* Jerry Bishop, a native West Texan and the paper's science writer whose byline has appeared on most of that newspaper's recent articles about cold fusion. Nigel says Bishop, who wrote a two-column article about the new invention, "was plainly impressed."

At the *New York Times*, the director of science news, Henry R. Lieberman, looked at the gadget, tilted

How a Rolamite Works

Performs Functions With Little Friction

A rolamite is essentially a suspension system that has the versatility to perform many mechanical and electromechanical functions with very little friction. It works on the principle of controlled interaction of a roller, or rollers, with a flexible — usually metallic — band or tape.

A typical design consists of four main parts — a rectangular frame, two rollers, and a flexible band. The ends of the band are attached to the frame so that the band is formed into an "S" shape. The rollers are then inserted within the two loops of the "S" and held in place by tightening the band.

This configuration allows the rollers to move freely with the band because there is virtually no sliding friction. The same roller, band, and guide surface areas always meet. This results in rolling friction coefficients as low as about one-tenth of those for ball and roller bearings acting under low pressures.

Controls Movement Precisely

Though low friction is a remarkable characteristic of the rolamite, it is the ability to control the movement of the rollers and the band, simply and precisely, that gives the concept its versatility. The performance of the roller cluster can be altered in several ways: by varying the size, shape, and weight of the rollers; by varying the configuration of the frame; by adding springs and other controls; and, most important, by tapering or perforating the band to introduce forces of the desired type.

Slots in the band create a force bias — a preference for the position on the band that gives it the greatest area contact with the rollers. For example, when one of the loops is weakened by tapering or by a cutout, the stronger loop dominates the weaker loop and unwinds, moving until the widest part of the slot reaches the point where the band first begins to curve around the roller.

This point represents the weakest part — with the least energy storage — of the band in contact with the rollers. By capitalizing on this phenomenon, and by varying the width of the slot along its length, innumerable spring-force functions — such as amplifying or damping — may be achieved.

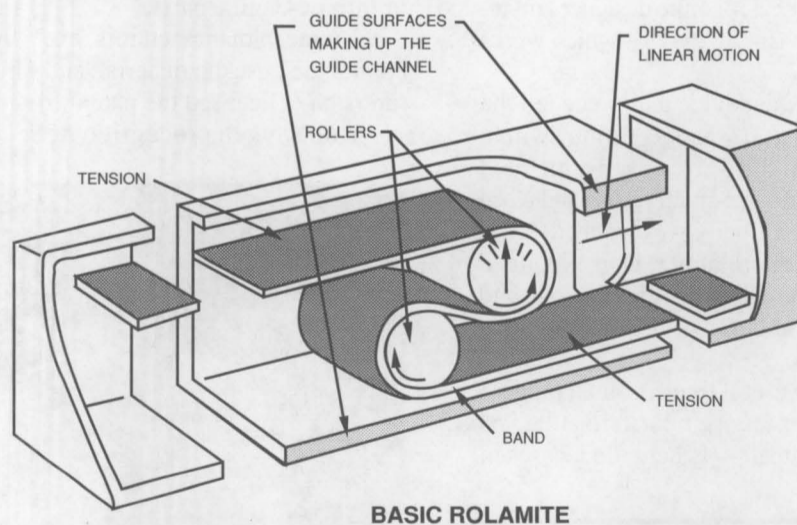
May Create Anti-Spring

Force bias in the rolamite also may be used to create a useful but elusive mechanical function — the negative or anti-spring. A typical spring creates a positive force — the farther it is pulled from its normal, unflexed position, the more force is required. Depending upon the configuration of its band, a rolamite can require less force the farther it's stretched — similar to the manner in which the attracting force of a magnet weakens with distance.

The negative spring is utilized, for instance, in an acceleration switch — in which the rollers are held in place by a triangular cutout until vehicle acceleration reaches a certain level. Once this breakaway level is achieved, the roller cluster quickly snaps to the other extreme position, closing a circuit and signaling achievement of the desired acceleration.

Sandia uses rolamites in most nuclear weapon systems as acceleration sensors for safing and arming. Normally, the sensors — known as G-switches — are filled with silicone oil, which flows between the roller cluster and the device casing as the switch is actuated. This provides a damping action, causing the switch to close more slowly as a further precaution against accidental closure.

At the time the switch is sealed, a bubble is introduced into the fluid. By growing larger as the fluid cools, the bubble helps maintain a constant damping effect by countering increased viscosity caused by the lower temperatures.



it up and down, all the while saying little. Then he left Nigel waiting at his desk for about 20 minutes while Lieberman showed the rolamite to some of his staff.

"He returned and gave me the model back with some complimentary but noncommittal remark, perhaps to the extent that it would make a good executive plaything," Nigel says.

Rolamite News Rolls In

Apparently Lieberman thought it also would make a good news story. On the front page of the *Times's* second section on October 17 was an article on rolamite, with two diagrams. Its author, John Noble Wilford, told Nigel the editors and reporters were intrigued by the device.

"It was one of those 'let's-run-it-up-the-flagpole' kind of things. It sounded too good to be true, but we didn't want to miss out on it," Wilford recalled later.

A month after the announcement, Don Wilkes quit his Sandia job to become a principal in a com-

pany established to develop commercial applications for the new mechanism. Because the rolamite was developed for the US Atomic Energy Commission, it could be manufactured under royalty-free licenses.

Don was soon to lament this open access to the rolamite. In a *National Observer* article, he was quoted as saying that by putting the application in the public domain, the government was "throwing the invention to the winds."

For Don and his dozen or so partners in Rolamite, Inc. — their new R&D company — the early winds blew in news about rolamite: An Iowa company produced a rolamite pressure gauge; a Wisconsin company was formed to manufacture a position-sensitive rolamite switch; an Albuquerque man patented a rolamite ski binding; and Rolamite, Inc. worked with Colt Industries to develop a rolamite trigger mechanism.

Meanwhile, out in California, Lon Bell was guid-

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ing his fledgling Technar Inc. in efforts to develop an acceleration switch using the rolamite principle (see "It Began With a Sandia Booklet"). Bell's company first manufactured a rolamite sensor that activated an emergency transponder in downed aircraft. Technar then added to its product line a rolamite switch that is a key element in automobile air bag systems.

Winds Have Long Been Still

For Don's company and the other rolamite manufacturers, those early winds of development have long been still.

The Iowa company, which has since moved to Nebraska, quit making the rolamite gauge years ago. "Evidently the manufacturing technology didn't pan out," says a company engineer. The Wisconsin company apparently no longer exists. John Kusianovich, the Albuquerque inventor who patented the rolamite ski binding, sells real estate. He says he sold the binding patent to a Seattle company, which never produced it and has since disappeared in a series of acquisitions.

Rolamite, Inc. is gone, too — dissolved in the early '70s after it was merged into a Los Angeles venture capital firm.

Don Wilkes is still inventing. And he will haul out models of many of the early rolamite products for visitors to his laboratory in northeast Albuquerque. The lab is his legacy from 13 years as an R&D executive. Four of those years were spent as a vice-pres-

"The ideas are what are important — the ideas inherent in rolamite, rather than rolamite itself."

ident of Rolamite, Inc. The company was based in San Francisco, but its research work was done in Albuquerque. It went public, had a successful \$3 million stock offering, but failed to generate enough interest in rolamite to stay independent.

In 1972, Foothill Group acquired the company, and Don, with his substantial equity in Rolamite, Inc., became a Foothill director. He continued to work out of the Albuquerque lab. Don says the financial losses of the former Rolamite, Inc., provided tax benefits for its new owner.

"After I used up the loss benefits for Foothill, the lab was acquired by Atlantic Richfield in 1978. This had some potential advantages both ways. They agreed to let me work on the wheelchair, and they wanted to use the lab for development."

'Something That Really Needs Work'

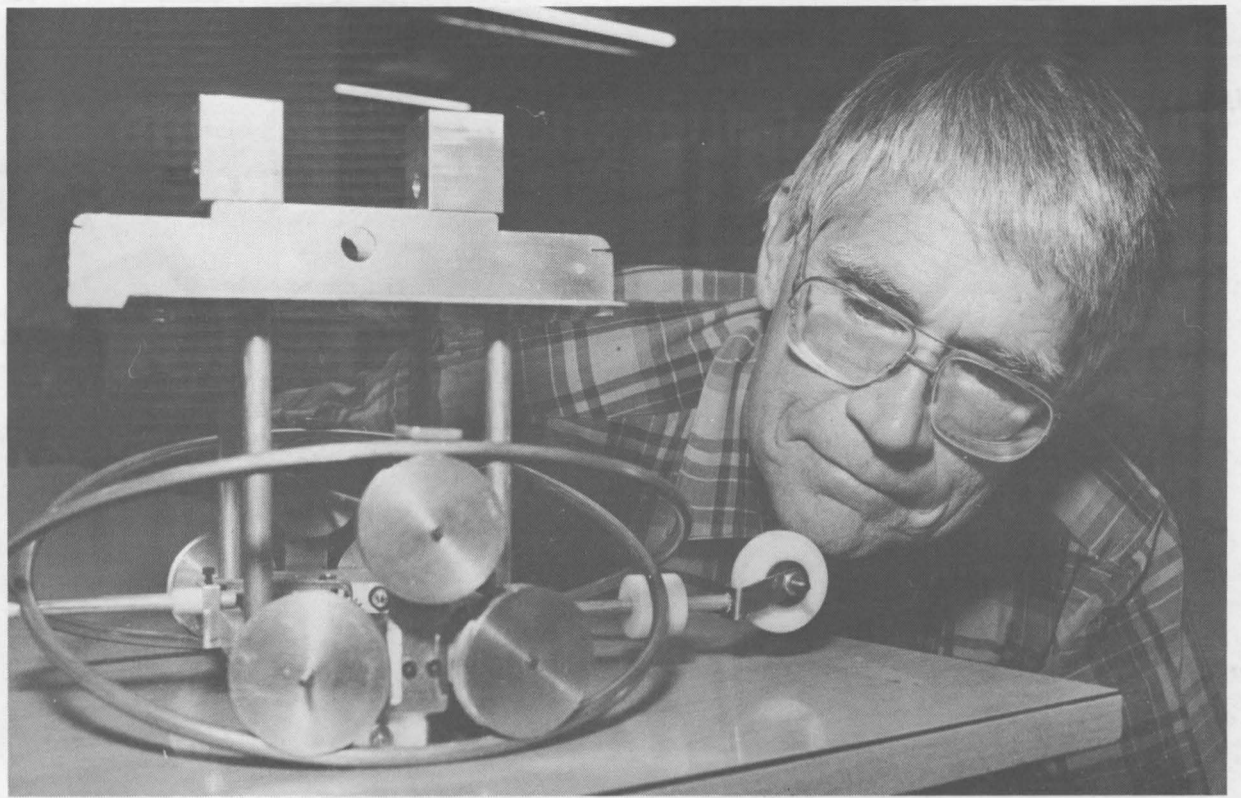
Don had begun developing a new type of wheelchair after Foothill asked him to investigate an innovation to a conventional chair in which it was considering investing. He says he was "appalled" when he looked closely at the design of the conventional wheelchair, developed in 1934.

"I decided that, boy, this is something that really needs work," he says.

Don's new wheelchair, which he has named the Life Cycle, has a self-adjusting center of gravity and normal rolling-type propulsion. Two coaxial hoops canted low near the ground are held in place with grooved rollers.

Don also has invented a new type of wave-action transmission, the heart of which is a circle of very thin spring steel confined within a smaller, rigid, circular housing. This configuration causes a wave-shaped lobe to form in the band. The transmission is infinitely variable from a maximum forward speed to a complete stop and into variable-speed reverse.

"There are a lot of variable-speed transmissions, but there are no others to my knowledge that will stop and go into variable-speed reverse. Another unique characteristic of this transmission is that the maximum rate of change is controlled so that you can't inadvertently kill the engine or do anything unsafe," Don explains. He says the new transmission could be adapted for use in appliances ranging from "the



IN 1989 DON WILKES (former Sandian) is still inventing. Here, he shows a small model of the wheelbase used in a new type of wheelchair.

smallest dental tool to equipment for public utility power stations."

Don's association with Atlantic Richfield ended in '81, when the company decided to move all its R&D work from Albuquerque to California. Don says he chose not to move, and Atlantic Richfield paid the rent on his lab for six months in a parting agreement. A Canadian investor has put about \$100,000 into the wheelchair project — enough money to get it patented — and Don says he hopes to find other investors.

Don says he also has been aided financially in his research by "a rather nice settlement" paid to him by a producer of a personal robot who infringed upon his canted wheel patent.

An Unhappy Irony

An unhappy irony occurred three years ago when Don, so deeply involved in work with the wheelchair and contributing office space and volunteer time to the Albuquerque Rehabilitation Center, was diagnosed as having multiple sclerosis. He remains active

Sandians Put Words in Dictionary

Sandia retiree Bob Fox put a new word in the dictionary. There it is on page 1021 of Webster's Ninth New Collegiate Dictionary: rol-a-mite.

"It's a small distinction, but I'll accept it," Bob says of his identity as the man who named rolamite.

Bob, who retired in 1985, says he received no prize for winning an informal employee contest to name Don Wilkes' invention. In fact, he didn't even get much enthusiasm from his co-workers.

"I remembered that it had rollers; they were talking about using laminates, and it's small, a mite, so I put them together. I said, 'What the heck?' and wrote rolamite on the board," Bob recalls. "Nobody liked it, but nobody thought of one any better."

Twenty-two years later, the name endures, along with Corry McDonald's (ret.) identification of rolamite as "an elementary mechanism," the basic classification stated in the Webster definition.

Corry, by the way, claims fatherhood of another word that has made its way into Webster's — retrofit. He says the word was coined in the early '50s when he and other Sandians were working on a project to put new parts in weapons.

"We were refitting them, but we didn't like refit, so we called it retrofit," he recalls.

and says his work with the center has taught him things that he can apply to his own case.

Don, who points out that he developed a dozen other technologies after he invented the rolamite, also believes his rolamite experience taught him things that he's applying to his current work. Indeed, discussions of the wheelchair and its novel transmission include words used in discussions of the rolamite — words like rollers, suspension system, and band.

When he reflects on his work with rolamites, Don de-emphasizes specific products. "The ideas are

"It takes sophistication to make something right. Sandia may have that sophistication, but others may not."

what are important — the ideas inherent in rolamite, rather than rolamite itself."

But Don doesn't believe his work with the rolamite was intangible. "The reason for working on rolamite was for a weapon-safing system. I set out to solve that problem, and I can't think of a use that could be more important," he says (see "Weapon Applications Since 1969").

Sandia has been using rolamites for that purpose for 19 years. The only other rolamite device manufacturer is Lon Bell's Technar Inc., now a subsidiary of TRW. This very short list was not what Don, Corry, and other Sandians envisioned 20 years ago when they were promoting the merits of rolamites.

Why Not More Uses?

Why didn't more companies embrace the rolamite? Don says industry uneasiness about the lack of patent protection was one of the obstacles. In a 1981 interview with an *Albuquerque Journal* reporter, Don said the patent freedom allowed competitors "to look over your shoulder, let you spend money working the bugs out, then make a few refinements of their own and undermine your efforts by turning out a less expensive and better product."

When asked if he holds that same opinion today, the inventor replies, "Yes, that's part of it. It's a complex question, but I don't think it's a good idea to have government ownership of something that has commercial potential.

"And I think another problem is it looks simpler than it is," he says. "Certainly there are things you have to do right, or it doesn't work right."

Don says he gets about a dozen calls a year from people who want to know more about rolamite, but most of those would-be developers soon lose interest. "A lot of them are looking for something that is ready to be put into production with no effort involved," he says.

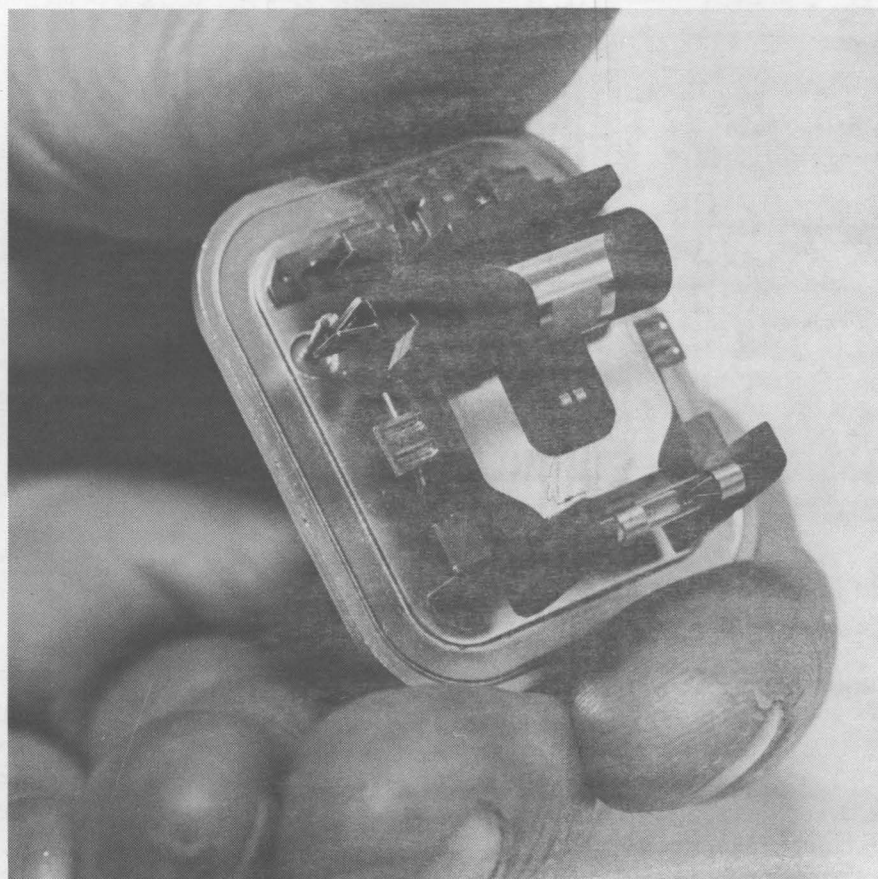
Don says precise guide surfaces and bands can

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It Began With a Sandia Booklet

Technar May Sell \$40 Million Worth of Rolamite Sensors This Year

THE TECHNAR AIRBAG rolamite is about the size of a piece of candy.



(Continued from Page Seven)

Rolamite

mean the difference between success and failure in rolamite production. "If you try to make a band with tin snips and sheet metal, it may not work so well. It takes sophistication to make something right. Sandia may have that sophistication, but others may not."

Presents Production Challenges

Fred Duimstra (ret.), one of the designers of Sandia's first weapon rolamite G-switch, agrees that the bands presented production challenges. "One of the basic disadvantages that we ran into when we branched out in other areas was difficulty in controlling the thickness of the band," he recalls.

Lon Bell says the rolamite's obstacle in becoming a jack-of-all-tools has been "making the performance repeatable." In addition to its sensitivity to guide surface finish and band shape and thickness, the rolamite also is sensitive to particulate contamination, he says.

Corry McDonald, a mechanical engineer whose list of a half-dozen patents includes curved windshield wipers, automatic transmissions, and automobile air conditioners developed for Packard Motor Company, agrees with Don that lack of exclusivity was one of the problems with moving the rolamite into private industry. "The question is: 'Why spend a lot of time and engineering unless you have exclusive rights?'" he says.

But Corry says there were other obstacles. Ironically, one was that companies simply didn't believe access to the rolamite principle was as easy as it was. "We found that if someone did apply it, they were a little disinclined to admit it. I suspect they were afraid they

would have to pay some kind of license fee," he says.

Corry also blames the economic temper of the '70s. "The basic economy was in a coasting mood; money was drying up for front-end projects," he says.

Competes With Other Capable Devices

John Ford (ret.) was the first supervisor of Sandia's rolamite division. Part of his job was explaining the new gadget to industry, something he did in dozens of seminars. He points out another problem with convincing manufacturers that the rolamite was destined for industrial stardom. While it might be capable of performing many tasks, most of those tasks were already being managed quite capably with devices manufactured with proven technology and existing tooling.

John cites a rolamite seminar he presented for Honeywell engineers as an example of that situation.

"Honeywell was big in thermostats. I was giving a seminar, showing this rolamite thermostat device. I said, 'This looks simpler; why not invest the money to make this?'"

"Their reply was, 'We agree with you, but we're making hundreds of thousands of thermostats. Why have money tied up in retooling? Why change and have to convince customers that the new thing is just as good?'"

Lon Bell summed up the attitude back in the late '60s when he told other rolamite pioneers, "It's the second-best way to do everything."

But there may be more chapters to be written in the rolamite story.

Don Wilkes still thinks the rolamite has excellent potential as a piston. John Ford says, "It's still a unique, clever concept. Someday there are going to be more applications. I just don't know when." And Joe Abbin (2542), one of John's successors as a rolamite designer and division supervisor, believes additional publicity about rolamite could inspire new uses for the mechanism.

Even Lon Bell, who has always been more temperate in his predictions for the rolamite, refuses to confine it to a single niche. When asked if he can think of any use other than the acceleration switch in which the rolamite excels, he is silent for several seconds, then replies, "No, I can't, but I would not be surprised if some are found." ●AEtheridge(3161)

Lon Bell built a million-dollar company on rolamite and an understanding that technology must match the customer's needs.

Perhaps the most moderate of rolamite pioneers in his vision for the new technology, Bell has guided his company, TRW Technar Inc., through more than 20 profitable years. Last year, Technar recorded \$31 million in sales. This year Bell expects that figure to burgeon to \$80 million. Half of those sales will be rolamite sensors, he says.

"Throughout the '80s, our growth has been phe-

Bell and his handful of researchers determined that the new technology was best suited for crash sensors.

nomenal, compounded at about 60 percent a year," Bell tells a caller to Technar's headquarters in Irwindale, Calif. Reflecting on the past two decades, Bell says it has been a pleasant business journey from Caltech graduate student to head of a company employing 600 people in two states.

A new Technar plant in Rochester Hills, Mich., is dedicated totally to rolamite manufacture. It is in addition to the Irwindale installation, which has two manufacturing plants and the company's R&D operations.

"Year after year we made a profit. Every year our sales grew. It never occurred to me to quit," he says.

'I Was Looking for a Technology'

Bell founded the company in 1967, the same year that Sandia announced the invention of the rolamite. "I was just finishing my PhD in mechanical engineering," Bell recalls. "I had no money, just what I be-



LON BELL says Technar expects 1989 rolamite revenues to be about \$40 million.

lieved to be certain technical skills, and I was looking for a technology that required low capitalization and was new enough that there was not a great history or great expertise."

That technology turned out to be rolamite. Bell learned about it from a technical exchange notice at California Institute of Technology. He got a copy of a Sandia booklet explaining the new technology, made some models, did some equations, and then be-

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gan manufacturing and selling his first rolamite product — a demonstration kit. He says many of his customers were Fortune 500 companies investigating the commercial possibilities of rolamite.

"We made thousands of those kits. That allowed us to gain some experience with rolamite devices, to get our name linked with rolamite," he says.

Bell may have gotten his name linked with rolamite, but he didn't get a reputation for being the technology's head cheerleader. While searching for the most profitable and efficient use for rolamite, he says he was somewhat less enthusiastic than other rolamite pioneers.

'Second-Best Way to Do Everything'

"I presented a very cynical and unpopular view: Rolamite is the second-best way to do everything. People didn't want to hear that," he says.

Bell says he continued to look for something that a rolamite could do better than anything else. After more than a year of study, modeling, and design analyses, Bell and his handful of researchers determined that the new technology was best suited for crash sensors — a conclusion not unlike that reached by Sandia researchers.

So while Sandia was developing rolamite sensors for arming and safing nuclear weapons, Technar was developing rolamite sensors that activated transponders for locating downed aircraft and rolamite sensors that activated air bags in automobile

... many of [Lon Bell's] customers were Fortune 500 companies investigating the commercial possibilities of rolamite.

crashes. The company quickly became a leader in the emergency transponder industry, gaining more than half of the private-aircraft crash sensor business, Bell says. "We sold more than a third of a million in about eight years."

The air bag business was slower. "It waxed and waned, depending upon politics and other factors in our government regulatory system," Bell says. Throughout the '70s, only 12,000 air bags were sold in the United States, he explained. But, of that early production, Technar's rolamite had 95 percent of the sales.

Air Bag Sensor Uses Single Roller

During those early years, Technar licensed its rolamite air bag sensor to Allied Chemical Company, which did the actual manufacturing. Technar manufactured the aircraft crash sensors and launch sensors for cruise missiles. While the missile sensors were similar to the Sandia acceleration switches, Technar's air bag sensor had a key difference from other rolamite devices — a single roller.

"We eliminated the second roller because a device having two parallel guide surfaces was very difficult to manufacture," he explained. But Bell considers the modified device a rolamite since it was clearly inspired by that technology.

The start of the '80s was a time of increased air bag activity for Technar, Bell says.

"In the late '70s, Allied chose not to participate in the air bag business, and we started dealing directly with companies interested in air bag systems," he recalls. "In the early '80s, we established relationships with Japanese and European automobile manufacturers. In the middle '80s, we started to manufacture for BMW, Porsche, and Honda. Shortly thereafter, we started to manufacture for Chrysler."

Today Technar has 15 air bag customers — Chrysler, the Corvette Division of General Motors, and four Japanese and nine European automobile manufacturers.

The Technar rolamite air bag switch, with a manufacturing cost in the \$10 to \$15 range, will activate

Tech Transfer Has Roots in 'Sixties

Technology transfer isn't new at Sandia. It's at least as old as rolamite.

Supplying information about that new mechanism was one of the early projects of the Office of Industrial Cooperation (OIC). The office was set up in mid-1967 within the Department of Technical Information under manager Bill Carstens (ret.). In late 1968, it became a division under the supervision of Corry McDonald (ret.).

Before the OIC was created, Bill's department disseminated information on Sandia's work that had technology transfer possibilities. "It was a minor activity, but we sent out a lot of reports," he recalls.

"There was a lot of demand for information on the [laminar air flow] clean room invented by Willis Whitfield [ret.] in 1961. That was one of the first big items," he says.

Corry had been one of the first members of a group that grew into the formal Federal Laboratories Consortium for Technology Transfer. He chaired the predecessor group from 1965 to 1968 and served as chairman of the New Mexico Industrial Development Executives Association, another group interested in technology transfer.

In the '70s, Corry continued serving as Sandia's technology transfer liaison while working to prepare the federal labs for the nation's complete conversion to the metric system. That movement, originally mandated by legislation, has since de-escalated to a voluntary effort.

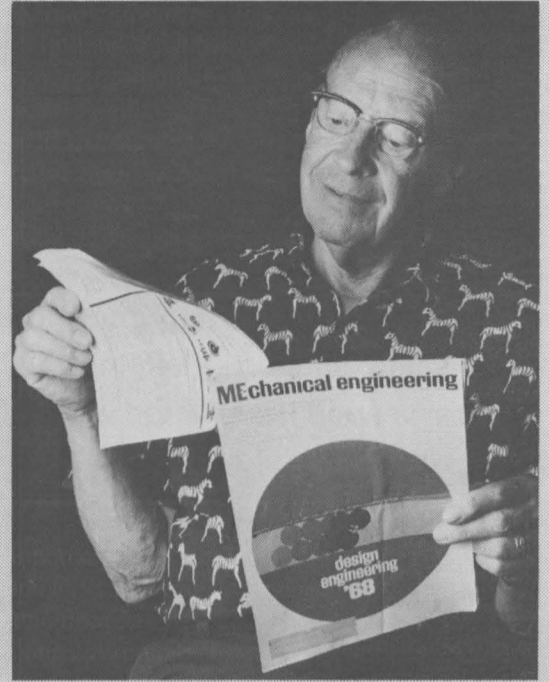
Helped Ensure Tech Transfer Funding

Corry retired in 1980, but, in his last couple of years at Sandia, worked with other members of the Federal Laboratories Consortium to ensure funding for technology transfer efforts.

The vehicle for this funding was the Stevenson-Wydler Technology Innovation Act of 1980, which required that a half-percent of the federal labs' budgets be allocated for technology transfer. The act also mandated that labs have at least one employee working full-time on technology transfer by Oct. 1, 1981. On that date, Bob Stromberg

(6010) became that person for Sandia.

In January 1986, the Technology Transfer and Management Department was organized under Glenn Kuswa (now 1237) as part of the Legal



CORRY McDONALD (ret.) looks over a copy of the April 1968 issue of *Mechanical Engineering*. As part of his work with Sandia's Office of Industrial Cooperation, Corry supplied much of the information for that issue, which featured the rolamite.

Organization (4000), taking over the function from the Management Staff Directorate (400). In late 1988, Glenn was succeeded by Dan Arvizu (6010), and the department moved to Organization 6000.

This month, technology transfer gained directorate status with the appointment of former Strategic Defense Initiative chief scientist Gerold Yonas to the position of Director of Technology Transfer and Special Projects 6100.

a bag in milliseconds. "The whole thing happens in less than a tenth of a second," says Technar marketing manager George Downs.

"Rolamites have proved to be very, very reliable devices," Bell says. To back up that statement, Downs cites the company's 15 years of manufacturing rolamite switches for non-nuclear military uses "with absolutely zero field failures." The company's growth from \$800,000 in 1980 sales to an estimated \$80 million this year was spurred in 1985, when it was acquired by TRW. "It made sense to become part of TRW, which provided leadership in systems

"The factor often overlooked is that a new technology must demonstrate a superior capability to meet a definable commercial need."

capability. The market potential required additional resources," Bell says. "There was an opportunity to be a significant factor. To do that and to demonstrate to our customers a stability that would make them feel comfortable, it was important to have greater capitalization."

The acquisition by TRW was beneficial for both the growth of Technar and the personal fortune of Bell, who acknowledges that the path he chose 22 years ago has made him wealthy. Seeking to ensure that the Technar management team would remain intact, TRW structured long-term contracts for Bell and

his key lieutenants — Allen Gillespie, William Gruber (recently deceased), and Robert Diller. All three were Caltech classmates of Bell and came to Technar in its first year of existence.

Next Generation in Three Years

Bell expects the team that put together the first rolamite demonstration kit will also be the team that oversees production of Technar's next generation of air bag sensors, which the company plans to introduce in 1992. He says the company will invest several million dollars in retooling for this next generation, which will have a simplified design, fewer parts, and will be built in a highly automated plant.

Bell predicts that air bag manufacturers eventually will incorporate both electronic sensors and rolamites in a single system, but he doesn't expect this type of product to be economically feasible before 1995.

Although Bell believes rolamites will continue to be part of air bag systems, he says Technar's fortunes are not pinned to the technology. Whatever technology is best is the technology Technar will use. He says that was the philosophy he had when he started the company and that is the philosophy he has today.

"This is a commercial business, not an effort to promote a particular technology," he says.

The Technar president believes that statement is a key clue to the sometimes mysterious process of technology transfer. "The factor often overlooked is that a new technology must demonstrate a superior capability to meet a definable commercial need. If it can be done, there is legitimate use of that technology. If not, it's often just wishful thinking," he says.

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Rolamite Uses to Extend Into 21st Century

John Ford (ret.) recalls the work that led to installation of the first rolamite G-switch in a nuclear warhead in 1970.

After former Sandian Don Wilkes invented the rolamite in 1967, a division was assigned to determine applications for it. John, who retired in 1973, said he was the "lucky guy" chosen to oversee that task.

"We set aside about five people to brainstorm," he recalls. The Sandia engineers determined that rol-

The [rolamite] device . . . continues to serve the same function — helping ensure that a weapon is activated when, and only when, it is intended to be.

amite devices might make a good replacement for some electric-mechanical weapon components. "Meanwhile, we got money allocated and set up a small shop for making the parts," he says.

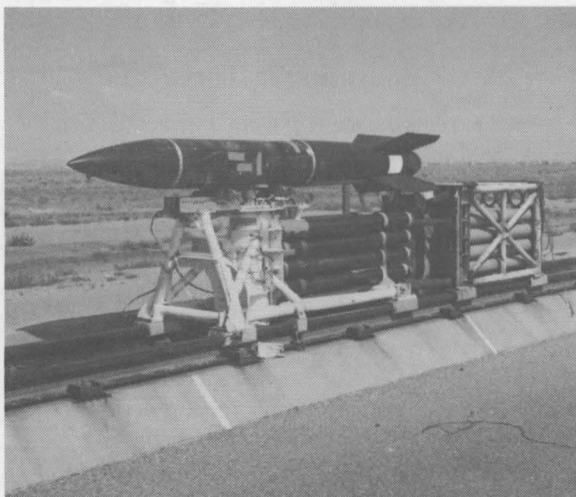
"About that time, there was a Vietnam application. I got a call to see if you could use rolamite for activating a device dropped from the air."

The Vietnam application — developed for the COIN or counter-insurgency program — was Sandia's first use of a rolamite. Joe Abbin (2542), who has worked with Sandia rolamites as a designer and division supervisor, explains that the COIN device contained electronic equipment that sensed troop and vehicular movement.

Sent Signals to Listening Post

The device was a tube about three feet long and three inches in diameter. It had a pointed nose at one end and fins at the other. Extending beyond the fins was an antenna that was camouflaged to look like a tree sprout. The device penetrated the ground after being dropped from an aircraft and stopped with the antenna protruding above ground level. On impact, a rolamite G-switch activated the sensor, which sent radio signals back to a listening post when motion was detected.

"That was in 1969. People saw that it worked,



THE B-61 WAS ONE OF THE FIRST nuclear weapons to have rolamites. A full-scale model of the B-61 is shown here in 1976 ready to be tested on Sandia's rocket-sled track.



JOE ABBIN (2542) holds the COIN (for counter-insurgency program) device that contained the first Sandia application of the rolamite. Joe is standing in front of a wall display that chronicles the development of Sandia rolamite applications.

and we had weapon applications after that," John recalls. The television-guided Walleye W-72 glide bomb was the first nuclear weapon to contain a rolamite. That application was followed in '74 by rolamite sensors to sense spin and parachute retardation of the B-61 bomb. In the late '70s, a Minuteman missile W-78 became the first reentry vehicle warhead to include a rolamite.

Weapon applications continue today and will go into the 21st century, Joe says. The device, while evolving in appearance and sophistication, continues to serve the same function — helping ensure that a weapon is activated when, and only when, it is intended to be.

Both the level and duration of acceleration are determinants for activation of these switches, Joe explains. Sandia engineers tailor the rolamites so that the roller-band assembly will not move and contact a switch until the proper acceleration has been sensed for a given time. Silicone oil put into the rolamite during manufacture serves as an additional damper to prevent premature contact with the switch.

Weapon rolamite development plans include devices that switch or direct light in a fiber-optic system.

Fred Duimstra (ret.) and Doug Schuler (7266) are the two designers whose names appear on the patent for the rolamite switch that went into the COIN device. Fred retired from Sandia in 1985 and works for Babcock Relays in Orange, Calif.

New Design Is More Rugged

Joe explains that the first rolamite G-switches had glass cases and were about the size of an automobile fuse. In the first half of this decade, Sandia began producing rolamite G-switches with plastic cases about the size of a small candy bar. The increased size and change in material made the new rolamite switches more rugged and easier to manufacture. Joe and Sam Martin (2541) were co-designers of this rolamite.

During that same period, Joe, Sam, and Clif Briner (2541) designed an improved version of the smaller rolamite. Until recently, Joe was supervisor of Division 2541, which works with rolamites. When Joe was appointed supervisor of Division 2542 in May,

Sam was named supervisor of Joe's old division.

Joe, Sam, and Larry Lukens (also 2541) have been working on a new project to develop a rolamite G-switch with a hermetically sealed steel case. This new switch will be sturdier and water-resistant. Moisture can permeate the cases and epoxy seals of the older designs. At low temperatures, this moisture can form into ice crystals that can impede the function of the switches, Joe explains.

Weapon rolamite development plans include de-

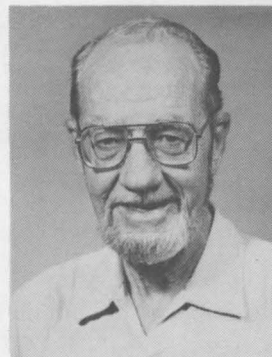
A new rolamite G-switch with a hermetically sealed steel case will be sturdier and water-resistant.

vices that switch or direct light in a fiber-optic system. Other concepts include rolamites that incorporate integrated circuitry with unique signals (codes) on the roller cluster, which are activated by proper deployment of the weapon.

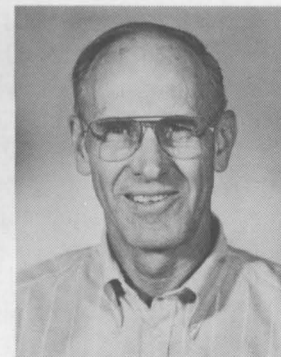
While Sandia's model shops still make prototype rolamite switches, they do not mass-produce them. The Sandia rolamites for nuclear weapons are manufactured by Raymond Engineering, Inc., in Middletown, Conn. Hamilton Technology, Inc., in Lancaster, Pa., also has produced switches for Sandia. ●



Retiring



Bill Neil (3423)



38 John Johnson (7132)

SANDIA

SANDIA

**SANDIA
TECHNOLOGY
TRANSFER**



(Continued from Page One)

Satellite Battery

and Testing (ETD) Project. Sandia is lead laboratory for the ETD Project, which is sponsored by DOE's Energy Storage and Distribution Office.

High Cost Holds Down Use

"The major drawback to using nickel/hydrogen batteries in terrestrial applications has been their high initial cost," says Ron. The aerospace version is one of the most expensive advanced rechargeable-battery technologies.

But Sandia has teamed up through a cost-sharing contract with Johnson Controls, Inc., (Milwaukee, Wis.) to bring those costs down. "The goal," says project engineer Don Bush (2525), "is to develop a version of the aerospace nickel/hydrogen battery that will be cost-competitive on a life-cycle basis with ordinary lead/acid batteries."

Since 1984, Don has led Sandia's Labs/industry efforts — first with Comsat Laboratories, more recently with Johnson Controls, Inc. (JCI) — to develop a highly reliable multi-cell nickel/hydrogen battery that will operate at costs that are economically feasible for terrestrial applications.

The aerospace version is expensive, Don says, primarily because its cells are housed individually in separate pressure vessels and because of the large amounts of platinum and nickel used in each cell.

"We've worked with JCI — they did the developmental work, we provided technical guidance — to redesign the battery so that a number of cells are housed in a common pressure vessel." To lower costs further, the terrestrial-use version was designed with thicker positive electrodes, which reduces the number of cell components needed. Additional cost reductions

"The same characteristics that make these batteries ideal for space vehicles make them particularly attractive for use at remote sites [on earth]."

were achieved by using negative electrodes containing less platinum/carbon catalyst.

"The major question is whether such modifications can be made to reduce the cost of the battery — without unduly compromising its performance," says Don. An aerospace version, he says, has been charged and discharged 7000 times without maintenance. That's equivalent to 20 years of operation in a terrestrial photovoltaic power system.

Currently under test is JCI's latest redesign of the aerospace battery — a 7-kWh unit believed to be the largest nickel/hydrogen battery ever assembled. Like its aerospace counterpart, the battery generates 1.2 volts per cell, but it is configured much differently (see "World's Largest Nickel/Hydrogen Battery").

It's being tested in a cooperative experiment with Photovoltaics Systems Research Div. 6223. Located in Bldg. 833, the battery is linked to a photovoltaic (PV) array just outside the building. The array is part of the Photovoltaics Advanced Systems Test Facility and is often used for evaluation projects, according to Ward Bower (6223).

Since September, the battery has also been linked to a small refrigerator and four 30-watt fluorescent lights to simulate a remote-site PV system.

"So far, our experiment is convincing us that this battery is ideal for use with PV systems," says Don.

Will Increase PV Options

PV technology — the technology that converts sunlight directly to electricity by means of solar cells — is now used as a reliable and cost-effective sup-



DON BUSH (2525, right) displays one of the nine "packets" that make up the nickel/hydrogen battery cell held by Ward Bower (6223). Ten such cells compose the 7-kWh battery currently under test in a cooperative experiment by Storage Batteries Div. 2525 and Photovoltaics Systems Research Div. 6223. The battery, located in Bldg. 833, is linked to the photovoltaic array shown behind Don and Ward and to a small refrigerator and four 30-watt fluorescent lights to simulate a remote-site photovoltaic system.

plier of electricity in remote regions that don't have access to electric power lines, says Ward.

But one niggling problem still dogs the technology and restricts its wider use in remote areas. The problem, Ward says, is not with the photovoltaic technology so much as with non-solar components that complete PV systems.

Because PV arrays generate electricity only while the sun is shining, some method for storing electricity for use at night or during cloudy days is needed. Maintenance costs usually are extremely high for such applications; thus, there is a need for low-cost, longer-lasting, low-maintenance energy-storage devices.

"Currently available batteries all have some inherent limitations," Ward says. "They're a weak link in small-scale PV power systems."

In most small PV systems, unsophisticated batteries are used — typically the kind intended for boats or golf carts — and, sometimes, nickel/cadmium batteries. Occasionally, even common lead-acid automotive batteries are used, but these, Ward says, are not generally recommended. All of these require some maintenance, periodic replacement, and, often, the use of a battery charge controller that may increase the

cost of the system and is another component that might malfunction

"Ideally, what is needed in electrical-storage devices for PV systems," says Ward, "is exactly what nickel/hydrogen batteries offer: longer life, low maintenance, the ability to operate without a charge controller, and the capability of tolerating frequent full-discharge or overcharge — without damage."

Further Cost Reductions Likely

Don is optimistic that the cost of the battery can be brought down even further to a level that will make it an attractive choice for remote-site PV installations.

"JCI is continuing the search for ways to reduce costs, especially of the electrodes. They're looking at using negative electrodes that contain even less platinum or some other material less costly than platinum. They're also considering using positive electrodes that are less expensive than the sintered, impregnated nickel plaques currently used."

Under development by JCI also is a less expensive pressure vessel to house the battery — no simple task, according to Don. "The battery must be assembled inside the pressure vessel — somewhat like a model ship is assembled inside a bottle." •DR

World's Largest Nickel/Hydrogen Battery

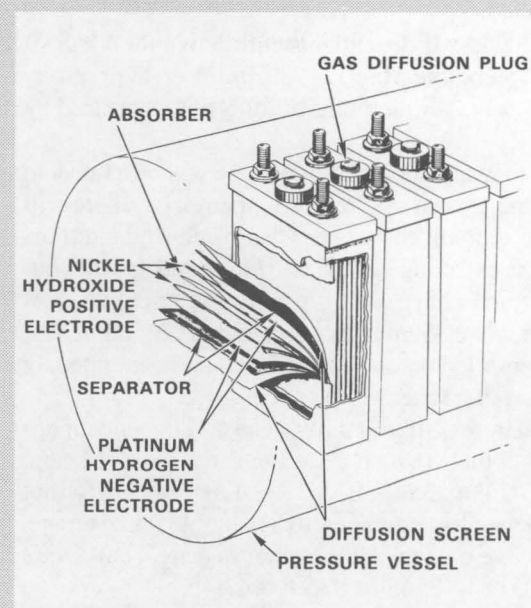
Without its enclosing pressure vessel, it may look like a common automobile battery, but the battery under test by Storage Batteries Div. 2525 is a redesigned version of a nickel/hydrogen battery that is a standard of the US space program. It's being tested to see if multi-cell nickel/hydrogen batteries can be built to operate for 20 to 30 years at costs that make them economically feasible for terrestrial applications (see main story).

Thought to be the largest nickel/hydrogen battery ever assembled, the current version — one of several being tested — is a 7-kWh battery that is configured much differently than its aerospace counterpart.

The aerospace battery consists of a series of individual cells, each sealed inside its own pressure shell that resembles the small propane cylinders used on camp stoves. The cells are linked to make a battery with the desired voltage.

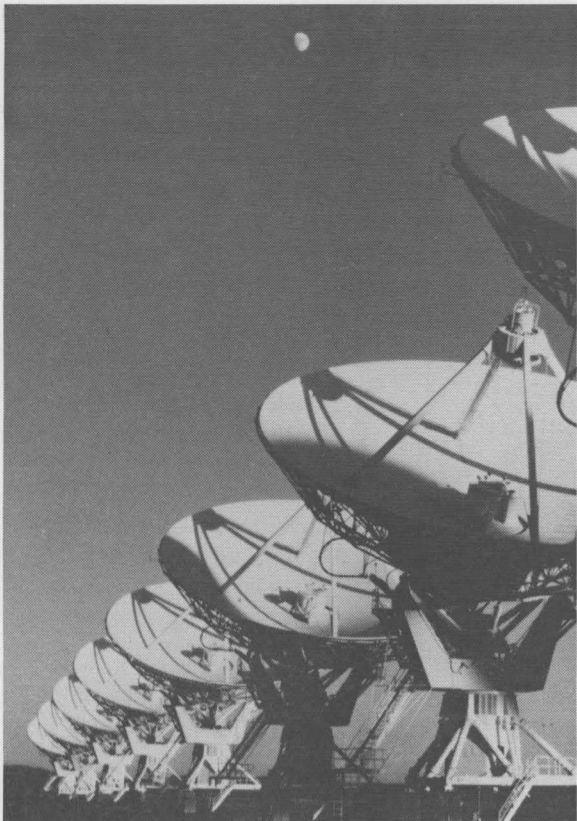
The terrestrial-use version combines a number of rectangular cells in a single pressure vessel, reducing the cost and making the system easier to handle. Other improvements include the design of thicker positive electrodes that increase the battery's capacity.

Each cell contains nine "packets" composed of two positive electrodes arranged back-to-back and two negative electrodes. Screens positioned outside the negative electrodes allow hydrogen to diffuse effectively to the entire surface of the negative electrodes and make an easy-to-handle packet (see drawing).



As a nickel/hydrogen battery is charged, it generates hydrogen gas, which forms at the negative electrodes from the electrolysis of water in the potassium-hydroxide electrolyte. The hydrogen is contained within the pressure vessel. When energy is needed from the battery, the hydrogen inside the vessel is recombined with oxygen to form water again, and electrons flow outward as a usable electrical current.

The battery's state of charge can be continuously monitored by following the hydrogen pressure, a unique feature of nickel/hydrogen batteries.



THE VERY LARGE ARRAY — the most powerful radio telescope in the world, located on the Plains of San Agustin in central New Mexico — will be open to the public in a special open house June 24 from 1 to 4 p.m. Visitors will be able to see the entire National Radio Astronomy Observatory VLA facility, including the new Visitors' Center, the Control and the Imaging centers (usually not open to visitors), and a close-up view of the 94-ft.-tall, 235-ton antennas. Jet Propulsion Laboratory representatives and VLA scientists will be available to answer questions. A slow-scan TV directly connected to the JPL in California will give visitors a chance to see the first pictures of Neptune sent back by Voyager. To reach the VLA, drive west on US Highway 60 from Socorro for 50 miles, make a left turn on State Highway 52, drive two miles, then make a right onto the VLA access road, and drive two more miles to the Visitors' Center. (Photo courtesy of NRAO)

For Your Benefit

Recertify Class II Dependents by July 14

All Class II dependents enrolled in the Medical Care Plan before May 1, 1989, will lose their coverage on Aug. 1 if their eligibility is not recertified by July 14.

If they are not recertified, there will be a break in coverage. And if you re-enroll them later, there will be a \$50/month charge per Class II dependent. (Participants enrolling new Class II dependents will continue to be charged \$50/month per enrollee. Not subject to the \$50/month payment are Class II dependents enrolled before Jan. 1, 1987, and continuously enrolled thereafter.)

Therefore, if you have a Class II dependent enrolled in the Medical Care Plan, see Doris Mason, Benefits Div. 3543, Bldg. 832/East, to certify that your dependent continues to be eligible for coverage. If you live outside the Albuquerque area, call Doris on (505) 844-3545 or FTS 844-3545.

Class II dependents include your unmarried children over age 24, your unmarried grandchildren, your brothers/sisters, and your parents/grandparents (or those of your spouse). Class II dependents must be financially dependent on you, must have lived in your home or one provided by you for the last six months, and must have a total income of less than \$7800 a year.

Sympathy

To Doug Clark (2313) on the death of his father in North Carolina, June 4.

To William Drozdick (2858) on the death of his mother in Scranton, Pa., June 5.

Take Note

Two Sandians, Ron Ewing (9111) and Jim Renken (2320), were elected to divisional executive boards of the American Nuclear Society in nationwide elections in May. Ron is serving a two-year term on the Executive Board of the Isotopes and Radiation Division, and Jim is serving a similar term and position in the Radiation Protection and Shielding Division.

Eleanor Walther (9114) was recently elected vice-president of the state board of the New Mexico Network for Women in Science and Engineering, a statewide organization that encourages women to pursue science and engineering careers.

The next meeting of the NMNWSE is June 21, 6 p.m., at Ellen Cronin's (1200) home. The evening includes dinner and a program by Virginia Moody titled "Breaking Barriers." There's a \$6 charge for dinner. Meetings are open to nonmembers. Call Donese Mayfield (9224) on 4-8811 or Beth Sellers (DOE) on 6-2102 for information.

Phil Apodaca (7556) was elected president of the Industrial Photographers of the Southwest (IPS) at the group's 30th annual conference in Albuquerque last month. Joining Phil on the IPS Board of Directors for the coming year are Louis Archuleta (3154), Diana Helgesen, and LeRoy Perea (both 7556). LeRoy's print, "Star Shower," was awarded first place in photo competition at the conference. It's a shot he took, while on assignment, from Haleakala Crater (Maui) of a Sandia rocket test.

Attention, Sandia retirees: If you wish to enter KAFB, obtain base decals from Sandia's Badge Office

in Bldg. 801. You must come in person and present proof of insurance, vehicle registration in your name, and a Sandia ID or a driver's license. Decals will be issued only to retirees living within a 50-mile radius. Vehicles must have a New Mexico license plate.

Sandia retiree Bill Carstens ("Class of '78," he says) has the title role in the Corrales Adobe Theatre's next production, "The Oldest Living Graduate," by Preston Jones. "I'm underage for the part," Bill reports. "This character's 75 years old, and I'm about six months short of that." The performances are at a storefront site next to the Burrito Co. in the Las Tiendas Shopping Center (northeast corner of Alameda and Coors NW). The play runs three weekends (Friday, Saturday, and Sunday performances at 8:30 p.m.) beginning June 23. More info on 898-9222.

Valley High graduates, Classes of 1959 and 1969, and Highland High graduates, Class of 1969, are holding class reunions in July and August. Information and reunion dates are available from Alice Smit or Janice Bonfantine on 821-0038.

The Volunteer Center of United Way of Greater Albuquerque is looking for youth ages 12-18 for summer volunteer work from June to mid-August. More than 70 nonprofit organizations have asked for help with filing, typing, yard work, bulk mailings, answering phones, visiting the elderly, serving meals to the homeless, serving as junior camp counselors, and reading stories to hospital-bound children. Matches between youth volunteers and agencies are made by the Center. For information, call 768-1007 or 247-3671.

Congratulations

To Patti (1420) and Dan Cover, a son, Brandon Christopher, May 7.

To Jeri Sue Goff and Tom Crenshaw (1832), married in Corrales, May 12.

To Karen and Mark (7243) Benner, a son, Steven Kyle, May 14.

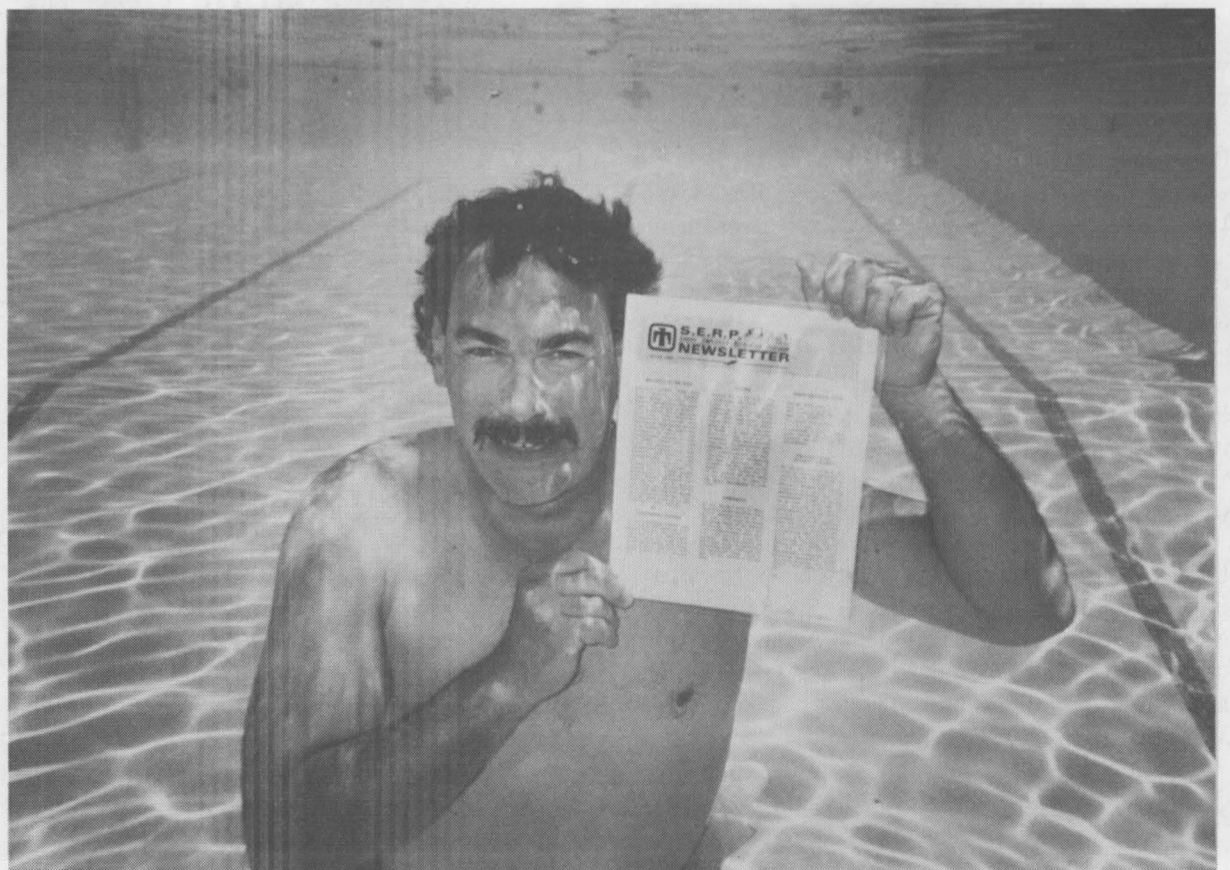
To Carol and Ed (1152) Vernon, a daughter, Dayna Rosalie, May 15.

To Gayle and Paul (110) Rosenkoetter, a daughter, Dana Lynn, May 18.

To Marcia and Barry (3202) Schwartz, a son, Aaron Jacob, May 22.

To Roxanna Sippio (2852) and Marc Polosky (2542), married in Albuquerque, May 27.

To Patricia and Rob (6334) Rechard, a daughter, Kara Louise, June 4.



IT'S OBVIOUS that Stan Ford, director of the Sandia Employees Recreation Program, will go to any lengths — or depths — to promote SERP. Here, at the bottom of the Coronado Club swimming pool, he proudly displays the *SERP Newsletter*, recently named a top employee-recreation newsletter in a national contest sponsored by the National Employee Services and Recreation Assn. Contest judges probably didn't realize that, in addition to its other attributes, the SERP publication is waterproof too.

Fun & Games

Backpacking — The American Lung Association 9th annual Backpack Trek in the Pecos Wilderness will be held July 12-16. For information, contact John Vitale on 265-0732.

More Backpacking — Frank Gerstle (7476) will present a backpacking workshop for couples June 21, 7-9 p.m., at the new YWCA of Albuquerque (7201 Paseo del Norte NE). Topics include selecting gear that suits your needs without breaking your back or bank account, planning trips and meals, and tips on how to stay on speaking terms when the tent leaks. Fees are \$6 for YWCA members and \$8 for nonmembers. For information, call Polli Gerstle on 822-9922.

Basketball — The 1989 Summer Basketball League will hold a pre-season meeting June 27 at the Coronado Club at 4:45 p.m. The season (tentative starting date is July 17) consists of ten regular games and a double-elimination tournament. The league is limited to 12 teams. Contact Jim Cheykay-chi (7242) on 4-7559 for registration forms. Complete forms (incomplete ones will be rejected) will be accepted on a first-come, first-serve basis. League fee (due at the meeting) is \$150 (one check per team, made out to SLBA).

Bowling — Kirtland bowlers are going to be B.A.D. — Bowling Against Dystrophy — Sunday, June 25, at KAFB's Kirtland Lanes. Everyone authorized to be on KAFB is eligible to participate, including spouses and family members. First shift is 1 to 3:30 p.m., second is 3:30 to 6 p.m. Registration starts a half hour before each shift. A minimum of \$35 per person in cash or pledges is requested. Prizes will be awarded.

Table Tennis — The 1989 Albuquerque Table Tennis Championships (sponsored by the Albuquerque Table Tennis Club and Albuquerque Parks and Recreation) will be held June 24, 9 a.m.-7 p.m., at the East San Jose Community Center (1830 Williams SE). Events include Novice Singles (first-time tournament players only, male and female), Open Doubles (two-person teams, male and/or female), Sandia/Kirtland Singles (Sandia employees and KAFB personnel, male or female), and Open Singles (everyone eligible, 16 players in descending order of rating). For entry forms, fee information, and schedules, call Jim Sanchez on 884-7597.

Tennis — Results of the May 27-28 Sandia Tennis Association tournament held at the Coronado Club courts were: Men's A Singles — Kevin Maloney (6412) defeated Jeff Tsao (1141); Men's B Singles — David Sealey (154) defeated Pat Fleming (9243); Women's Singles — Damarius Pimentel took first and Audrey Paulsen was second; Men's A Doubles — Alex Pimentel (1823) and Ernie Melo defeated Larry Schneider (1252) and Tom Mehlhorn (1262); Men's B Doubles — Joe Ruggles (2629) and Bill Candelaria defeated Robert Cutchen and Scott Devonshire; Mixed Doubles — Mark Tucker (5246) and Terry Martinez (1240) defeated Joe Ruggles and Charlene Schaldach (2643). Mark Tucker organized the tournament. The next tournaments are scheduled for June 24-25 and July 22-23. For information on the Sandia Tennis Association, contact Kevin Maloney on 6-6578 or Ken Hanks (7823) on 4-1820.

What's That You Say?



It is not uncommon for a car stereo enthusiast to pay \$20,000 for 24 speakers that are capable of blasting out thumping, ear-splitting music at up to 143 decibels. Competitions to decide who has the loudest cars are all the rage. When jets take off, the noise level ranges from about 125 to 148 decibels. Normal speech is about 60 to 65 decibels. But decibels are measured on a logarithmic scale — a 143-decibel car stereo is about 100 million times louder than normal conversation. The stereo aficionados justify their obsession as an expression of individuality. "Who's anybody to tell me what's too loud," said one defiant devotee recently. It's doubtful that he heard the reply.

New Scientist

Readership Survey Results

Every few years, the LAB NEWS sends a readership survey to a randomly selected group of Sandians to determine how well the paper is read, most popular/least popular features, etc. We're a bit tardy, but we thought you might be interested in the results of the last survey.

Questionnaires were sent to five percent of the Albuquerque staff last summer when Bruce Hawkinson (now 3153 supervisor) was still editor. About 65 percent of the group completed and returned the questionnaires. The final results were compiled earlier this year. For comparison purposes, we're also showing the results of the previous survey done in 1985.

All figures are in rounded percentages.

How well do you like the LAB NEWS?

	1985	1988
Great	8	8
Good	54	66
Okay	35	23
No Opinion	3	1
Only Fair	1	2
Poor	0	1

How much of it do you read?

Most	39	41
About Half	49	51
Little	12	9

Do you take it home to share with family members?

Yes	65	56
No	35	44

Most popular features: (% of respondents who read these features)

Technical Stories	87	92
Management News	84	85
"Unclassified" Ads	77	73
Feedback Items	76	83
Employee Honors	76	70
Medical Corner	72	81
Mileposts	75	76
For Your Benefit	73	72
Supervisory Appointments	73	70
Editor's Column	57	68

Least Popular Features: (% of respondents who read these features)

Savings Bonds	27	31
Volunteers in Action	39	46
Employee		
Contribution Plan	40	40
Colloquium Reports	41	*
Retiree News	44	44

(Note: No retirees were surveyed)

(* No longer carried)

Historical Context Valuable?

Yes	79	82
No Opinion	19	15
No	2	3

Readers were also asked to identify specific stories or issues that they most remembered.

In 1985, readers most remembered the following (with most-remembered listed first): State of the Labs issue, a fusion special issue, and the technical accomplishments issue.

In 1988, readers most remembered the following: Labs accomplishments issue, State of the Labs issue, smoking policy, Soviets at TOSI (Technical On-Site Inspection R&D facility), removal of KAFB Parade Ground poplars, Center for Radiation-Hardened Microelectronics special issue, parallel computing, superconducting films, Saturn facility, and a farewell salute to Dick Claassen.



CECIL LAND (DMTS, 1163) displays a Corporate Achievement Award presented by the American Ceramic Society to Sandia for its development of electro-optic ceramics and for the commercialization of electro-optic flashblindness goggles for the Air Force. Cecil, who began his pioneering research on the electrically activated solid-state ceramics in 1969, accepted the award on behalf of Sandia at the Society's recent annual meeting in Indianapolis. Bob Eagan (1800) is president-elect of ACS and will take over the presidency next April.

MILEPOSTS

LAB NEWS

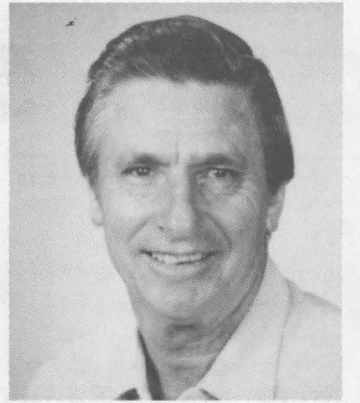
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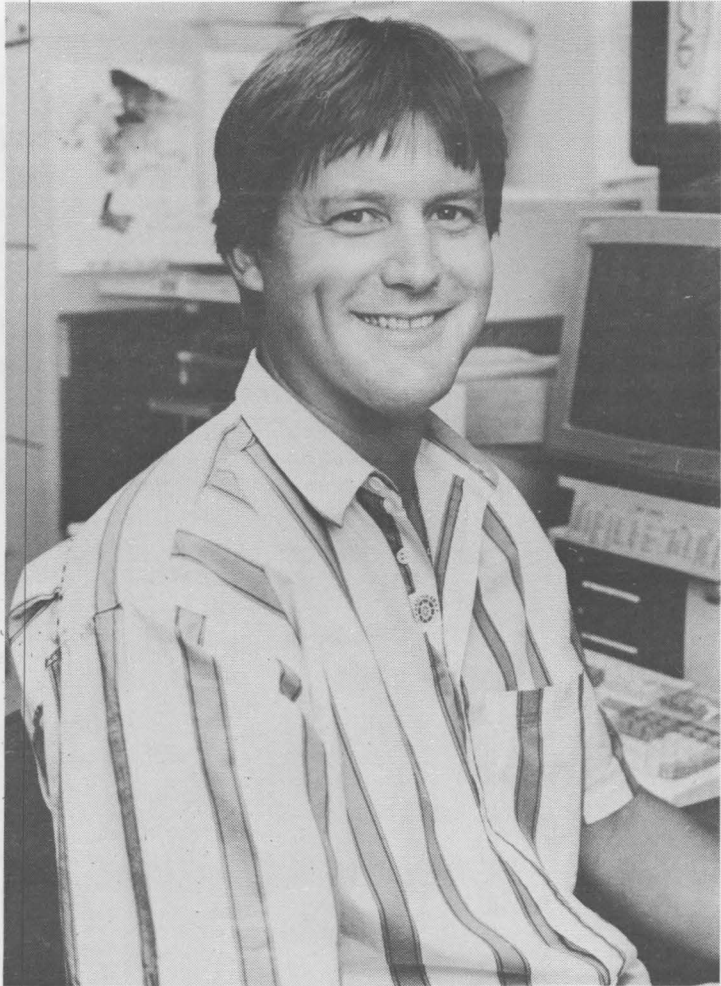
Wayne Chrisman (8347) 25



Estrella Dulleck (2634) 15

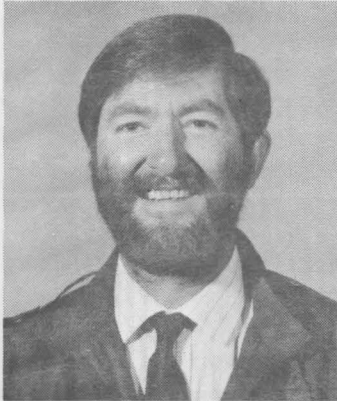


Harold Hunt (8513) 30



Rod Shear (7116)

15



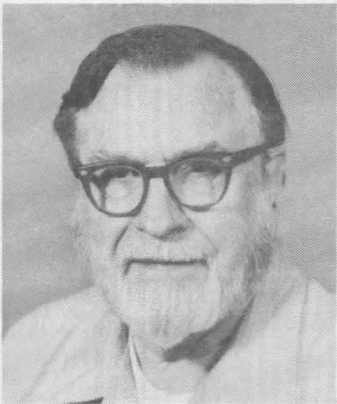
John Anthes (2531) 15



Ben Benedetti (8241) 25



Clarence Washington (9211)
25



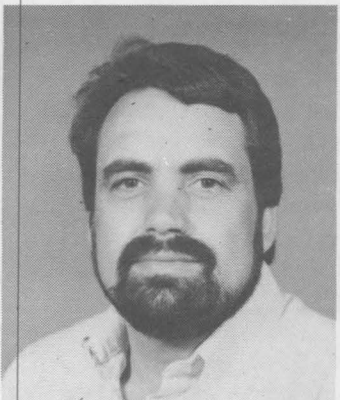
Bob Buxton (7252) 30



Earle Chapman (5113) 30



Jerry Wackerly (8524) 30



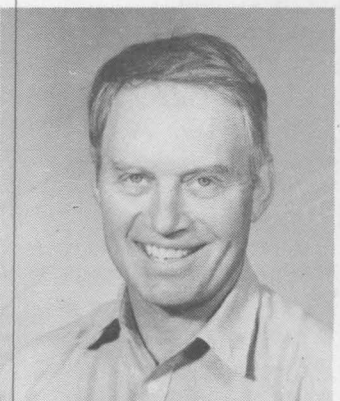
Frank Lasky (2522) 15



Mabel Hurley (3151) 15



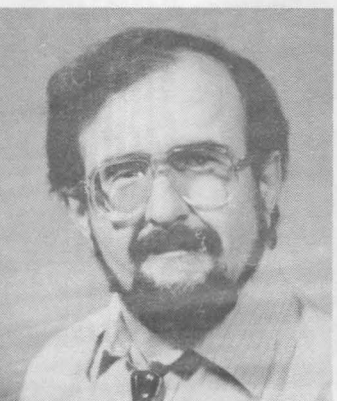
John Seuser (8284) 30



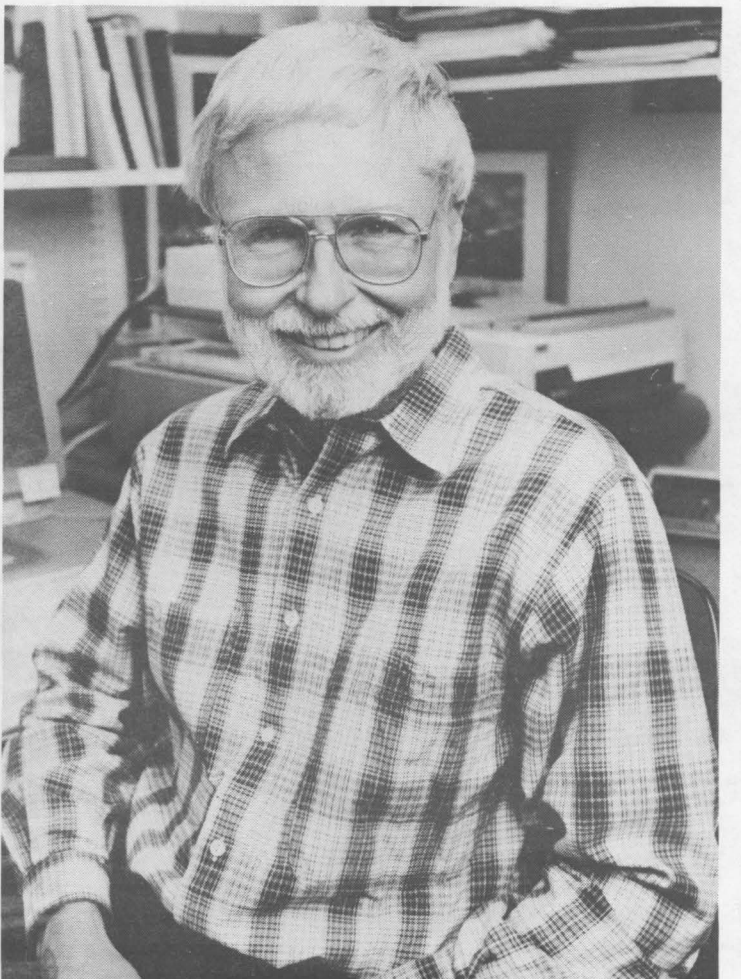
Ben Conklin (6452) 30



Ernie Alford (8161) 40



Robert Miera (2832) 15



Jim Nowak (6332)

20

UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

Deadline: Friday noon before week of publication unless changed by holiday. Mail to Div. 3162.

Ad Rules

1. Limit 20 words, including last name and home phone.
2. Include organization and full name with each ad submission.
3. Submit each ad in writing. No phone-ins.
4. Use 8 1/2 by 11-inch paper.
5. Use separate sheet for each ad category.
6. Type or print ads legibly; use only accepted abbreviations.
7. One ad per category per issue.
8. No more than two insertions of same "for sale" or "wanted" item.
9. No "For Rent" ads except for employees on temporary assignment.
10. No commercial ads.
11. For active and retired Sandians and DOE employees.
12. Housing listed for sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

YOUNG GEESE, free to good home. Bauer, 266-8480.

ADULT-SIZE WHEELCHAIR, Everest & Jennings. Faculjak, 898-6502.

HOLIDAY TRAVEL TRAILER, 19', self-contained, new tires, spare, AC, brake controller, \$2700. Stuart, 299-9190.

CAMPER SHELL, white fiberglass, Toyota LWB, \$300; 8 tires, 4 on rims, \$100; light bar for Toyota, \$40. Cooper, 881-1329.

BEDROOM SET, 5-piece contemporary, walnut, dining room set; table; full-size mattress; king-size bedspread; more. Prindle, 292-3334.

BABY CRIB, \$85; miscellaneous baby items; metal desk, w/swivel chair, \$85 OBO. Liguori, 256-3613.

MAN'S SMALL WETSUIT, Victory 3/2, full body, \$50; Mistral Tarifa, 10' 8", 160L, \$300. Holmes, 292-0898.

TV TRAYS, set of 4, \$10; snow tires, 15" on Olds. rims, \$30/ea. Carter, 293-6750.

WINDSURFER SAILS, 8.0 m² Windwing CLE camber, \$250; 6.6 m² topsails, camber, \$150. Ritchey, 298-4311.

ELECTRIC-WINCH TOWING BAR and cross bar, for under car pulled by RV. Rael, 884-4778.

THREE-PIECE CHERRY DINING ROOM SET, \$900; 4-piece maple bedroom set, \$600; Wurlitzer console piano, \$1100. Stewart, 293-3959.

RUGER SUPER BLACKHAWK 44-mag., fired approx. 100 rounds, \$240. Nichols, 275-1241.

ESTATE SALE: engraved brass (India) decorative items, carved teakwood chests and table, carved leather-topped tables, more. Alexander, 884-4930 for appointment.

FURNITURE: twin-size headboards/footboards, 2, Early American, \$85; bookcases, 2 shelves, unpainted, \$35/ea.; dining set, \$200. Sons, 294-3953.

VAN GAME TABLE, chrome pole, \$50 OBO; black-stone table tops, 18" x 60", \$25/ea. Moreno, 294-4268.

WATER SOFTENER, Culligan Mark 5C, \$350. Baca, 298-7748.

TENT TRAILER, Tradewinds hardtop, sleeps 6, icebox, stove, sink, heater, \$400. Beauchamp, 884-4749.

TRAVEL TRAILER, self-contained, \$2500; desk, \$25; 2 bar stools, \$25/ea. Silva, 897-2857.

ANTIQUE OAK DRESSER, 4-drawer, wishbone mirror, \$180 OBO. Clouten, 243-6384.

COACHMAN TRAVEL TRAILER, 22', self-contained, AC, TV antenna, \$6100. Witkowski, 299-6402.

AKC-REGISTERED POMERANIAN, male, 2 years old, show quality, trained, \$300; full-size bed,

boxspring, frame, \$50. Montano, 891-0921.

PC/TERMINAL STAND, on casters, 21" x 18", \$25; desktop Universal printer stand, new, \$15; approximately 50 foreign/domestic empty beer bottles, free. Schubeck, 821-3133.

SHOTGUN, Browning model A-5, 12-gauge, modified choke, Belgian-made, \$450. Sinton, 298-2483 after 5.

ARABIAN HORSES: geldings and mares, professionally trained, terms available. Ellis, 869-3582 after 5:30.

OLYMPUS 35MM CAMERA, OM/PC 50mm lens, 70-210 telephoto lens, flash unit, case, best offer. Carli, 298-9271.

POOL TABLE, regulation 9' x 5', slate, leather pockets, dark walnut, will help dismantle and move, \$1500 OBO. Aragon, 294-4275.

THOMAS 25-PEDAL ORGAN, \$1000; Sears 6-hp shredder/bagger, \$100; 35-gal. glass-lined water tank, \$30; sewing-machine desk, \$20. Minnear, 344-5419.

KIRBY VACUUM CLEANER, w/attachments, \$75. Prevender, 296-8586.

PLAYER PIANO, 1920 Windsor w/restorable Baldwin mechanism, mahogany, w/matching bench, plus music-roll cabinet, \$1300. Nordeen, 296-7898.

WATER SKI, Jobe SR glass slalom, \$75. Pletta, 281-4277.

WALNUT COMPONENT STEREO CABINET, \$100; Dynaco components: amplifiers, FM tuner, \$100; gun safe, holds 24 guns, \$400; commercial mitre box, \$75. Hickman, 296-6989.

ORIENTAL-DESIGN RUG, all wool, 5' 7" x 8' 2", \$100. Neal, 292-8675.

KITTENS, 8 weeks old, part Siamese, weaned, litter-box trained, free. McGovern, 275-3725.

WHITE BOXER, 1-1/2 years old, tail bobbed, dew claws removed, neutered, AKC-registered, w/doghouse, \$100. Cusenbary, 839-9387 leave message.

COMPUTER, IBM XT clone, 512K RAM, amber monitor, Turbo Pascal 5.0, Turbo Tutor software, \$450. Lifke, 821-3816.

TWO-WHEEL TRACTOR UTILITY CART, holds 600 lbs., 2' high removable front & sides, welded-steel frame, \$100 OBO. Hughes, 299-6674.

IBM SELECTRIC TYPEWRITER, \$150; 1/4-cord firewood, \$20; glass fireplace screen. Pilat, 292-4727.

EIGHT SLIDING DOORS, solid wood, 24" x 78-1/2", cost \$130/ea., sell for \$50/ea. Pitts, 293-5481.

MACINTOSH COMPUTER, printer, external disk drive, software, manuals, cables. Timmerman, 298-4587.

WATER SOFTENER, Kenmore model 50, \$250 OBO. Mora, 281-9815.

GERMAN SHEPHERD PUPS, full-blooded, 8 weeks old on July 4 weekend, 3 females, 2 males, \$75/ea. Craig, 869-6513.

KING-SIZE WATER BED, headboard w/mirror and shelves, 12-drawer pedestal, mattress, heater, padded rails, \$250. Garcia, 822-1401.

TRACK LIGHTING, Dynasty Classic model 1802-3, from Price Club, new, still in boxes, \$25/ea., \$100/5. Cabe, 293-6895.

TERRI-POO PUPPIES, 9 weeks old, no shots. Martinez, 345-2149.

SATELLITE DESCRAMBLER, Video Cipher 2, model 2100E, \$250. Rice, 842-9457 after 5.

MOLDED MARBLE DUAL SINK, new, 90" long, 23" deep, 4-3/4" back-splash; two 50" washbowls, w/matching soap dish. Stang, 256-7793.

BROTHER TYPEWRITER w/IF50 interface for IBM-compatible computer, instructions and cable, 2 KB memory, daisy wheel, \$75. Henry, 266-6467.

REFRIGERATOR/FREEZER, Sears Coldspot, frost-free, 16.6 cu. in., copper-tone, \$65. Mason, 299-2836.

STEREO, 16" x 94", \$90; garage refrigerator, \$30. Gallagher, 822-0383.

DRESSER & CHEST OF DRAWERS,

blond, \$40/ea.; antique bed, \$40; sofa and love seat, \$165; rust rocker, \$30. Reed, 821-6315.

FIVE-PIECE SECTIONAL, includes 2 recliners and hide-a-bed; oak table and chairs; twin-size bed; VCR; car bike rack. Broyles, 281-1917.

MAINE COON CAT, purebred, pedigree, show cat, female, spayed, all shots current, \$50. Blaine, 265-4588.

DOMESTIC TENT, 3-person, High Sierra, \$20. Montoya, 296-4268.

WET SUIT, Hang Ten, size XL, red, blue, and gray, \$100. Fisher, 298-0526.

AIRLINE TICKETS from Albuquerque to Los Angeles on June 30, 3 at \$25/ea. or make offer. Whitley, 865-4390.

MOTORCYCLE HELMETS (full-face): Bell Star size 7, Black Star size 6-3/4, orange, \$45/ea.; motorcycle cover, silver, \$20. Weirick, 281-1462.

MOTOR OIL, 2 cases Pennzoil 10W-40. Randall, 821-0388.

GUITAR AMP, 2 models available, \$100/ea. Chavez, 836-4069.

LAWN MOWER, Great States brand, push type, used one season, cost \$55, sell for \$30. Mooney, 281-2612.

SEAR CAR-TOP CARRIER, \$50; army rucksack, metal frame, \$15; spare tire & rim for Chev. van, \$8. Bennett, 298-1142.

QUEEN-SIZE WATER BED, w/6-drawer pedestal, \$125. Frumkin, 255-3429.

TENT TRAILER, '78 Jayco Jaydove, sleep 8, propane stove and heater, kitchen has sink, icebox, 20-gal. water tank, \$1095. Leonard, 884-8566.

IRIS AND HERRINGBONE GLASSWARE, service for 6, \$475; other pieces: demitasse, coasters, sherbets, candy-jar cover, candlesticks. Goetsch, 892-8366.

TRANSPORTATION

'80 CHEV. CITATION, \$1400, will trade for pop-up tent trailer or guns. Zamora, 865-6280.

'85 NISSAN 300ZX, 5-spd., 30K miles, \$9000. Syler, 299-2941.

'77 AMC GREMLIN, AT, PS, 6-cyl., 258, AM/FM cassette, \$800 OBO; '76 Suzuki, GT750, trunk, saddlebags, fairing, \$900 OBO. Vernon, 892-6571.

'84 VW GTI, sunroof, AC, AM/FM cassette, 5-spd., 48K miles, 1-year warranty remaining, \$4700. Garrett, 275-3707.

'79 HONDA PRELUDE, original owner, all service records, 5-spd., silver/gray, 26/34 mpg, recently tuned, 89K miles, \$2750. Barr, 821-5870.

'76 TOYOTA CELICA, new tires, \$900. Martinez, 821-6096 after 5 and weekends.

'71 MAVERICK, 2-dr., 6-cyl., recently overhauled. Gonzales, 265-2671.

'86 KAWASAKI VOYAGER III, 1200cc, loaded, matching helmets, intercom, stereo, Dunlops, full dress, \$3900 or trade. Peirce, 242-3790.

'88 GEORGIE BOY MOTOR HOME, 32', basement model, all extras. Eifert, 268-1854.

'86 BAYLINER BOAT, 14', 50-hp Force, canvas cover, AM/FM marine radio, power tilt, life jackets, trailer, \$3000 OBO. Henry, 831-3099.

NORTHWEST RIVER SUPPLY SPRITE RAFT, 5-man, frame, oars, 2 life jackets, foot pump, \$650. Mills, 881-7884 leave message.

GIRL'S SCHWINN BICYCLE, 27", 10-spd., red, 3 years old, \$95 OBO. King, 294-6161.

MONGOOSE BMX BIKE, 20", coaster brakes, \$75 OBO. Phipps, 299-3151.

'85 YAMAHA 700cc MOTORCYCLE, 1 med. and 1 large helmet included, \$1600. Costales, 821-6084 after 4:30.

MAN'S HUFFY CATALINA BICYCLE, 10-spd., white, 27" wheels, spare tires and tubes included, \$40. Stang, 256-7793.

'87 PONTIAC TRANS AM TPF1, T-top, AT, loaded, 23K miles, \$12,000 OBO. Mills, 823-4484.

'72 CHRYSLER SKI BOAT, 16', open bow, Volvo 130 I/O, with accessories. Reed, 821-2195.

'78 MOTOR HOME, 19', all power, roof/cab AC, GMC 350, stove, refrigerator, shower. Richardson, 293-4219.

REPOS: '77 LINCOLN MARK V, 2-dr., 8-cyl., sunroof, needs repair; '68 Cadillac Fleetwood, 4-dr., 8-cyl., PW; bids accepted through June 19. We reserve the right to refuse all bids, subject to prior sale. SLFCU, 293-0500.

'87 CAMARO Z28, dark red/gold, all power, extended warranty, 23K miles. Rex, 344-6552.

'74 KARMAN GHIA, \$2900. Silva, 897-2857.

'76 PLYMOUTH VOLARE, 2-dr., V-6, AT, AC, sunroof, AM/FM cassette, recent major tune-up, \$800. Almaraz, 299-9654.

'85 YAMAHA THREE-WHEELER, 200cc, \$750. Jakubczak, 892-6322.

'67 CHEV. IMPALA CLASSIC, 80K miles, 327 engine, 4-dr. hardtop, AC, AT, PS, radio. Zurawski, 884-3862.

'87 FORD F150 PICKUP, AT, AC, PS, PB, cruise, AM/FM, dual tanks, 302 EFI, take over payments of \$306/mo. Zamora, 865-7214 after 5.

'82 CHEV. PICKUP, SWB, V-8, 4-spd., AC, PS, PB, shell, 37K miles, one owner, \$4700 OBO. Kureczko, 281-8206.

'86 FORD BRONCO, full-size, 302 V-8, 4-spd., PS, PB, stereo, AC, new clutch and shocks, \$7900. Ritter, 298-7315 or 294-3339.

MAN'S SCHWINN VARSITY BICYCLE, \$50. Prevender, 296-8586.

'49 JEEP CJ3, tow bar, canvas top, \$1200. Schuster, 299-1072.

'81 BUICK RIVIERA, loaded, white exterior, burgundy interior, 60K miles, available June 30, \$6700. Hamilton, 294-5850.

'76 KAWASAKI KZ900, 16.6K miles, new tires and battery, \$850. DeReu, 275-2336.

'80 KAWASAKI LTD 750 MOTORCYCLE, black, windshield, new tires, \$1200 OBO. Aragon, 294-4275.

'78 FORD F150 EXPLORER PICKUP, V-8, AT, AC, 8' bed, 75K miles, second owner, \$4300. Coalson, 298-0061.

'83 YAMAHA 750, 4.3K miles, \$1300. Edwell, 299-4551.

'79 PONTIAC GRAND LeMANS, 71K miles, 4-dr., V-8, AT, PS, PB, cruise, new radial tires. Linnerooth, 299-6558.

'82 ELDORADO MINI-RV, 20', complete, generator, AC, 34K miles, \$14,500. Howe, 881-6834.

'68 DATSUN 510 SW, full records, AM/FM cassette, AC, 4-spd., \$1000, make offer. McGovern, 275-3725.

MOUNTAIN BICYCLE. Broyles, 281-1917.

'75 DATSUN B210, w/blown '81 engine, 15K miles on tires, \$125 OBO. Welcher, 275-1367.

'85 NISSAN KING-CAB PICKUP, 4x4, new tires, 33K miles, \$7400, make offer. Howard, 839-9203.

'85 MUSTANG LX, 3-dr., cruise, PB, PS, AT, AC, white, 4-cyl., 28-mpg, 45K miles, \$5200. O'Neal, 298-2859.

'72 OLDS. VISTA CRUISER, PS, PB, new battery and recent tune-up. Martinez, 345-2149.

'81 MERCURY LYNX, one owner, 52K miles, AM/FM, \$1350. Klamerus, 821-7295.

'79 CADILLAC SEVILLE, white, 98K miles, \$4500 OBO. Yuhass, 294-9605.

'82 FORD 250XLT SUPER-CAB PICKUP, 4-WD, AC, AT, PS, dual tanks, running boards, brush bar, 55K miles, \$6100. Melvin, 298-6402.

'83 INTERCEPTOR 750, cover, engine guard, 3.6K miles, \$2800. Allen, 898-9209.

GIRL'S BIKE, 20" Schwinn "Li'l Chic," w/training wheels, \$65. Dandini, 296-4975.

REAL ESTATE

3-BDR. HOME, all brick, 2 baths, Taylor Ranch area, FP, fully landscaped, solar and upgrades, handicap access, 9-1/2% FHA assumable loan, \$89,000. Faculjak, 898-6502.

1/2 ACRE, Navajo Dam, on San Juan River, w/14' x 70' mobile home, 24' x 24' steel garage, fruit trees, irrigation system. Holloman, 1-632-3488.

3-BDR. MOSSMAN HOME, 1-3/4 baths, den, FP, hardwood floors, new carpeting, screened patio, RV pad, storm windows, 9-1/2%, \$97,500. Smith, 881-3580.

4-PLEX, NE Heights, pitched roof, W/D hookups, storage sheds, city/mountain views. Stewart, 293-3959.

2-BDR. HOME, 1560 sq. ft., Sun North Estates, landscaped, community pool/clubhouse/racquetball, 2 homes available. Reed, 821-2195.

4-PLEX, 2-bdr. units, 9 years old, individual meters, \$10,000 down, 8-1/4% mortgage, REC, \$100,000 total. Kinney, 268-3222.

3-BDR. MOBILE HOME, Palm Harbor, 28' x 70', Vineyard park, 2 baths, shop, storage, 2-car garage, RV storage. Illing, 344-0453.

2-BDR. MOBILE HOME, 2 full baths, refrigerator, dishwasher, updated carpet, covered porch, 14' x 70', \$15,900. Dunham, 293-6971.

1/2-ACRE LOT in Deer Lake Estates, bordering Santa Fe National Forest, w/mobile home, well, septic tank. Ard, 299-0863.

NEW 3-BDR. HOME, Rio Rancho, 2 baths, window seats, extras, assumable loan, 7.9% fixed, \$4000 down, \$418/mo. Martinez, 891-2226.

COLORADO RIVER-FRONT LOT, 1 acre, 200 miles from Albuquerque, \$5000. Madsen, 294-3235.

3-BDR. MOBILE HOME, '73 Parkwood, 12' x 65', w/tip-out 20' x 14' LR, raised roof over kitchen and LR, 1-1/2 baths, skirting, porches, approved wood stove, jack, \$7000. Dollahon, 298-1151.

1360-SQ.-FT. HOUSE, views, Indian School east of Tramway, \$84,000. Knittle, 294-6625.

3-BDR. HOUSE, near Gibson gate, 1 bath, formal DR, country kitchen, gardens, trees. Nelson, 881-7281.

4-BDR. HOME, 1940 sq. ft., Tramway/Indian School area, remodeled, \$97,000. Sleefe, 281-4103.

NE TOWNHOUSE, \$16,999 down (below equity), \$585/mo., \$76,900. Padilla, 299-2637.

WANTED

LIFE JACKETS, adult- and child-sized, suitable for use w/sailboat. Klarer, 344-0612.

SUPER-8 MOVIE CAMERA and projector, in good condition. Sparks, 821-8442.

VIOLIN and 1/2-size cello. Leisher, 281-5258.

TRANSPORTATION for bedroom suite from Albuquerque to San Francisco, add-on in a move, will help with cost. Myers, 265-7293.

BING CHERRIES, any reasonable price or we'll pick your tree in exchange for some. Neal, 292-8675.

INFORMATION on mail-order video and camera-equipment dealers, good and bad experiences. Cabe, 293-6895.

NISSAN PULSAR, '83-'86, AT. Chavez, 298-4607 leave message.

RESPONSIBLE HIGH-SCHOOL STUDENT willing to house-sit, pet-sit, tutor (K-8th), or babysit, Chelwood and Indian School area. Graham, 293-7302.

'85 SUBURBAN OWNER'S MANUAL, to borrow. Hansche, 281-5623.

HOUSEMATE, female, nonsmoker, to share 3-bdr., 3-bath home in Taylor Ranch, \$250/mo.+share utilities. Bassett, 897-4712 or 898-1840.

LOST AND FOUND

SILVER AND BLACK EARRING lost in Tech Area I June 6. Surma, 293-2420.

Pampered Papas Parade To Patio Party Sunday

DIS FOR DAD — and the doting way he's treated you all these years. Here's your chance to show your appreciation: Celebrate Father's Day on Sunday (June 18) at the C-Club patio, where a magnificent BBQ spread featuring all kinds of papa-pleasin' food — grilled steaks, BBQ ribs, hamburgers, and all the trimmings — will be available from noon to 5 p.m. Bring along the bathing suits and enjoy a relaxing swim somewhere along the way. Free admission for members; \$3/person for guests.

TONIGHT'S MOTTO: Peel those shrimp and tote that T-bone! Those are the mouth-watering menu items (\$8.45 and \$9.95, respectively) available this evening at the Friday night dinner. Afterward, there's a special treat in store for fans of Big Band tunes. If "In the Mood," "Little Brown Jug," and "String of Pearls" are music to your ears, you'll be pleased as punch; Roland De Rose and crew will play those songs of yesteryear (and many more) for dancing from 8 to 11 p.m. Reservations requested (265-6791).

FAMILY SWIM NIGHTS on Wednesdays (June 21 and 28) are a great way to live it up in the middle of the week. Head for the pool/patio area (open until 8 p.m.) right after work to enjoy low-cost buffet items, cartoons on the big-screen TV, and a cool dip. Regular admission rates: free for pool-pass holders, \$2/Club members, and \$3/guests.

THE STAGECOACH FROM DOWN SOUTH stops at the C-Club next Friday night (June 23) to deliver some of Isleta's better-known residents. That's right — the Isleta Poor Boys belt out the stomp music from 8 p.m. to midnight for all you sagebrush shufflers. Beforehand, tired trail riders can chow down on either prime rib (\$1.25/ounce) or grilled herbed chicken (\$6.95) — pretty elegant food, we'd say, for a desert outpost.

IF YOU'RE A KID who's bonkers for bingo, mark Sunday, June 25, on your calendar. That's the day you can win all kinds of prizes (except cash) at your very own bingo get-together. There's a low-cost buffet served from noon to 1 p.m., when the bingo action starts. Bingo tab: just \$2.50/player.

THE BEAT GOES ON — the bingo beat, that is — with two more sessions (for adults, this time) scheduled on June 22 and 29. Check out the prize-display case in the C-Club lobby to find out what's in store for some of the big winners. Cards go on sale at 5:30 p.m., and the early-bird game starts at 6:45 both nights.

THE T-BIRD SHUFFLE is not a new kind of dance. Rather, it's what the Thunderbird card sharks do when they get together for fun and games. The next opportunity for frivolous fun and convivial conversation (plus gratis goodies) is Thursday, June 29, starting at 10 a.m.

April 1989 Earnings Factors

	Earnings Factors
Savings Plan for Salaried Employees (SPSE)	
AT&T Shares	1.1045
Government Obligations	1.0153
Equity Portfolio	1.0490
Guaranteed Interest Fund	1.0071
South Africa Restricted Fund	1.0348
Diversified Telephone Portfolio	
Unrealized Appreciation	1.0831
Realized Appreciation	.0081*
Savings and Security Plan — Non-Salaried Employees (SSP)	
AT&T Shares	1.1069
Guaranteed Interest Fund	1.0071
South Africa Restricted Fund	1.0347
Diversified Telephone Portfolio	
Unrealized Appreciation	1.0818
Realized Appreciation	.0080*

* The 1 has been removed from the earnings factor. Current month's DTP earnings may be calculated directly: Earnings Factor X DTP Current Worth = Current Month's Earnings.

Events Calendar

- June 16 — "The Value of Names" by Jeffrey Sweet, benefit performance sponsored by Los Alamos Little Theatre of drama that won 1989 Southwest Region Theatre Competition sponsored by the American Association of Community Theatres; 8 p.m., Theatre-in-the-Making (3211 Central NE), 260-0331.
- June 16-17 — Village Festival: music, food, facepainting, storytelling, puppets, T-shirts, and dinosaurs, proceeds benefit working classroom storytellers and the Books for Bluefields project in Nicaragua, sponsored by South Broadway Cultural Center; 12-8 p.m., South Broadway Community Park (Garfield & Broadway SE), free, 848-1320.
- June 16-17 — "You Say Chaqueque and I Say Shaqueque," La Compania de Teatro de Albuquerque presentation of earthy cuentos (folk tales) and chistes (riddles) from Northern New Mexico adapted for the stage, bilingual, with live music; 8 p.m., South Broadway Cultural Center, 848-1320.
- June 16-July 16 — "Albuquerque by Six," exhibit of works by Albuquerque photographers with commentary by V.B. Price; 9 a.m.-5 p.m. Tues.-Sun., Albuquerque Museum, 242-4600.
- June 16-Sept. 15 — "Raymond Jonson Cityscapes," exhibit featuring drawings and paintings by Jonson from the 1920s to 1940s; 9 a.m.-4 p.m. Tues.-Fri., 5-9 p.m. Tues. evening; Jonson Gallery, UNM Art Museum, 277-4967.
- June 17 — Summerfest '89: Juneteenth Night, ethnic foods, entertainment, and arts and crafts; 5-10 p.m., Civic Plaza, 768-3490.
- June 17 — Summer Solstice Program: cultural and historical background of sundials and how to use them; 1 p.m., Rio Grande Nature Center (2901 Candelaria NW), 344-7240.
- June 17 — Annual Watermelon Festival: benefit for La Puerta de los Niños child-care center and preschool, featuring entertainment by the Watermelon Mountain Jug Band, silent auction, and food; 2-6 p.m., Uncle Cliff's Amusement Park, 884-2999.
- June 17 — Saturday Night Wild at the Zoo: featuring barbershop choral concert by the New Mexi-Chords, family fun, and international foods; 6-10 p.m., Rio Grande Zoo, 298-3355 or 842-7280.
- June 17 & 24 — "Humpty Dumpty, Over Easy," Youth

- Performance Workshop presentation of story-theatre with audience participation; 2 p.m., Theatre-in-the-Making (3211 Central NE), 260-0331.
- June 18 — 10th Annual Father's Day Concert sponsored by the Friends of the Corrales Library, featuring entertainment by Cadillac Bob and the Rhinestones, Watermelon Mountain Jug Band, Frank Larrabee and Jim Siegling, Bill and Bonnie Heame, Del Rios, Primitive Edge, the WDC Band, and Lunch at the Dump; 1-8 p.m., Corrales Village Park, 898-3798.
- June 18 — Arts in the Parks Father's Day Celebration: family entertainment; 1-5 p.m., Hyder Park (Richmond & Pershing SE), free, 764-1525.
- June 18 — Father's Day Ice Cream Feast: all the ice cream you can eat for \$2 admission, music, entertainment, door prizes, and prizes for children; 6-9 p.m., Albuquerque Museum, 242-4600.
- June 18 — Multi-Ethnic Festival: dance performances and booths featuring Native American, Irish, and Spanish foods; 10 a.m.-4 p.m., Indian Pueblo Cultural Center, free, 843-7270.
- June 23-24 — "Lone Star and Laundry and Bourbon" by James McLure, night and day in Texas, recommended for mature audiences; 8 p.m., Theatre-in-the-Making (3211 Central NE), 260-0331.
- June 23-25 — 28th Annual New Mexico Arts and Crafts

- Fair: works by more than 200 New Mexico artists, keynote exhibit, food booths, and entertainment; 10 a.m.-10 p.m. Fri. & Sat., 10 a.m.-6 p.m. Sun.; State Fairgrounds, 884-9043.
- June 24 — Summerfest '89: Scandinavian Night, ethnic foods, entertainment, and arts and crafts; 5-10 p.m., Civic Plaza, 768-3490.
- June 24 — San Juan Feast Day: Buffalo and Comanche dances, food, and more; San Juan Pueblo, 843-7270.
- June 24 — "The Bank Street Show," barbershop music, featuring the New Mexi-Chords; 7:30 p.m., KiMo Theatre, 298-3355.
- June 24-25 — Natural Dye Festival: celebrating the ancient art of fiber dyeing; 10 a.m.-5 p.m., Rio Grande Nature Center (2901 Candelaria NW), 344-7240.
- June 29 — San Pedro Feast Day: Corn dances at San Felipe, Santa Ana, and Santo Domingo Pueblos, 843-7270.
- June 29-30 — "Mixin' It Up," Bill Evans Dance Company with Albuquerque jazz group No Mean Feat; 8:15 p.m., Popejoy Hall, 277-3121.
- June 30 — "An Evening of One-Act Plays," fantasy and fancy, one-acts by George Bernard Shaw, David Hwang, and John Guare; 8 p.m., Theatre-in-the-Making (3211 Central NE), 260-0331.



ASTRONAUT LINDA GODWIN (left) spoke at the June 8 Cultural Awareness Colloquium on her experiences in a nontraditional career field for women. Here, she compares notes ahead of time with Women's Program coordinator Debbie Eaton (3510).